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A RECONNAISSANCE IN THE CASPIAN PROVINCES OF PERSIA

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THE Caspian provinces, owing to their isolation by the barrier of the Elburz Mountains, to their dense forests, and to their having been intentionally left with undeveloped communications for political reasons, have hitherto remained one of the least-known corners of Persia. Nor was it altogether safe for travellers to venture to those parts until a year or two ago when the gendarmerie arrived and disarmed the turbulent, feudal officers of the Shah's Mazandaran army, who spent their time fighting one another in the forests and sometimes rebelling against the authority of the Shah. The Caspian country is now again disturbed by the renewed rebellion of the Jangali tribes of Gilan.

For previous knowledge of the Caspian country we have the authority of Lord Curzon, who in his book gives a chapter of information on Mazandaran; then there is the record of the French Scientific Mission and the accounts of Mr. H. L. Rabino, *Geographical Journal*, 1913, and two German travellers. We have no proper maps of the Caspian provinces; the existing degree sheets, being drawn largely from hearsay, are more misleading than helpful. Mr. Rabino, while British Vice-Consul at Rasht, prepared a fairly good map of Gilan; and it still remains the best available of that part. It is known that the Russians had an accurate large-scale map of the coastal country, but this was secret, and has never been seen by the public. The country presents some difficulties for survey; but no doubt the survey will soon be accomplished when the political disturbances have subsided, as our mapping parties have already carried the half-inch sheets as far as Tehran. Meanwhile the accompanying sketch-map may perhaps serve to fill the gap and illustrate the route along the coast.

While at Kazvin in March 1920, Captain Fortescue and I had the good fortune to receive orders to proceed on a reconnaissance tour through Mazandaran to Gilan along the Caspian coast. A hurried departure at four days' notice had to be made; a surveyor could not be taken; and lack of time, and consequently lack of freedom of plan, prevented our

profiting fully by the opportunities that a visit to such a country could offer. Therefore this is, I fear, no very informative narrative, but only a short and simple account of a quick reconnaissance of what is certainly a most interesting country.

There is a choice of routes from Tehran. The Savad Kuh is the main caravan trading route to Barfarush and Sari, but the Harhaz road is shorter, more difficult in winter owing to snow, and the more interesting route to Mazandaran. It is 110 miles to Amul, crossing the mountains by the Imam Zadeh Hashim Pass under the shadow of Mount Damavand. From the north-east gate of Tehran a broad metalled road swings out over the plain. The mountains lie in a horseshoe around. The plain is shingle-strewn and barren, but away in the distance at the foot of the mountain slopes one sees villages prettily grouped among tall trees and greenery. The road steers straight for the great cone of Mount Damavand, king of the Elburz, and highest mountain in Persia. There is a village of the same name to which this carriage road leads. The place is a favourite summer resort of the people of Tehran, as it lies amid delightful scenery with the best shooting and fishing. The Shah's shooting preserves are in the vicinity.

One rides on over the ridge of hills to Jajarud, picturesquely set among willows and poplars on the banks of the broad river of the same name, and then climbs up a branch valley to Kermandah Serai, the end of the first stage, 18 miles from Tehran. Above Kermandah the road debouches on to an elevated rolling plateau intersected here and there by nullahs draining away eventually to Jajarud. The peak of Mount Darud, 12,600 feet, rises beyond; and along the left flank is the wall of the Elburz, at this season thickly covered in snow. The carriage road leads to Damavand village, but the track to the Imam Zadeh Pass branches up a valley to the north, leading to the village of Ah, the second stage from Tehran, right in the heart of the mountains. On the morrow we were to cross the Elburz by the Imam Zadeh Pass and drop over into the Lar valley and the Mazandaran province in the Caspian country.

The Charvadars urged an early start from Ah, as it is a long march over the pass, and it is necessary to cross before the sun softens the snow. The track, about 2 miles above Ah village, leaves the valley, climbing steeply up the hillside to the east over a preliminary pass into the Damavand valley. The col was broad, open, and thickly covered in snow. From it one looks down to Damavand village; the track does not descend, however, but winds up the hillside, reaching the summit of the final pass by a steep zigzag along a built-up path. At the summit is a serai where travellers may rest if necessary. The view to the south is a splendid open panorama of the Damavand plain and the outer ranges of Elburz with the Great Plateau beyond. To the north there is only a narrow view of mountain cliffs and a steeply dropping valley clogged in snow. The mules find a difficulty in the descent, particularly when

another caravan is met. Then one lot of animals has to step off the trodden track into the deep snow, which is liable to slip away with them down the hillside. The lateral valley descending from the pass is so confined that it is only on reaching the Lar valley that Mount Damavand is first seen. Here the great cone rises straight in front of one. The base of the mountain is immensely broad. The La Valley is rugged; and for many miles the river flows through a gorge, so the road, after crossing to the left bank, is forced to mount up on the flanks of Damavand, keeping sometimes 2000 feet above the river owing to the precipices below.

The scenery on the Caspian side has changed. There are no elevated plateaux and rolling plains as on the south side of the mountains, but the ground is rugged and precipitous, and the valleys drop rapidly to the sea. There is a police post and serai at the junction with the La Valley; but as there are only scanty supplies available, the first convenient halting-place is Rehna village, a long way down, and some 27 miles in all from Ah. Beyond Rehna, the path descends from the elevated shelves to the river-side. Some curious rock-hewn dwellings are passed, described by the natives as "sangars." This is the most thickly populated part of the Harhaz valley (Harhaz being the name of the lower Lar valley), and many villages are passed on either side of the river. Lower down there are few villages, as the ground is too rugged for cultivation. The road passes along the face of the cliffs on outbuilt galleries, well made but narrow, and a little tricky unless you are certain of your riding-horse. The pack-ponies are not worried by the precipices, and will go anywhere as long as they can get a path broad enough for their loads.

In the absence of villages one finds frequent artificial caves cut into the hillside, built as a protection against horse thieves and brigands. Animals can be shut up inside while the charvadars sleep guarding the entrance. These caves still form the regular caravan halting-places. We put up one night at the caves of Ayo, 20 miles below Rehna. There was snug accommodation in them for two hundred mules and ponies. On the next stage there were no villages except the police post at Siah Bisheh, where the officer in charge courteously turned out his men for inspection and salute and despatched a mounted man in advance to arrange everything at the next halting-place. The politeness of the people is perhaps one of the chief charms of travel in Persia. The traveller is greeted and entertained; in villages a house is always placed at his disposal; and at the serais in this valley where there are few villages one can still be comfortable, as the men bring all requirements, grain for the animals, and a steaming samovar for tea, with eggs and chupattis and a charcoal fire. The Gendarmarie under Swedish officers is well organized. You find their posts along all the trade routes, even in these wild valleys. They are always armed and ready to turn out, always smart and efficient. They have brought order and peace to the caravan roads formerly so notorious

for brigandage. The Gendarmerie seem to be on a different footing from the Cossacks or Persian army proper under Russian officers. One can only describe the Cossacks, if an alliteration may be excused, as lazy, lousy, and licentious.

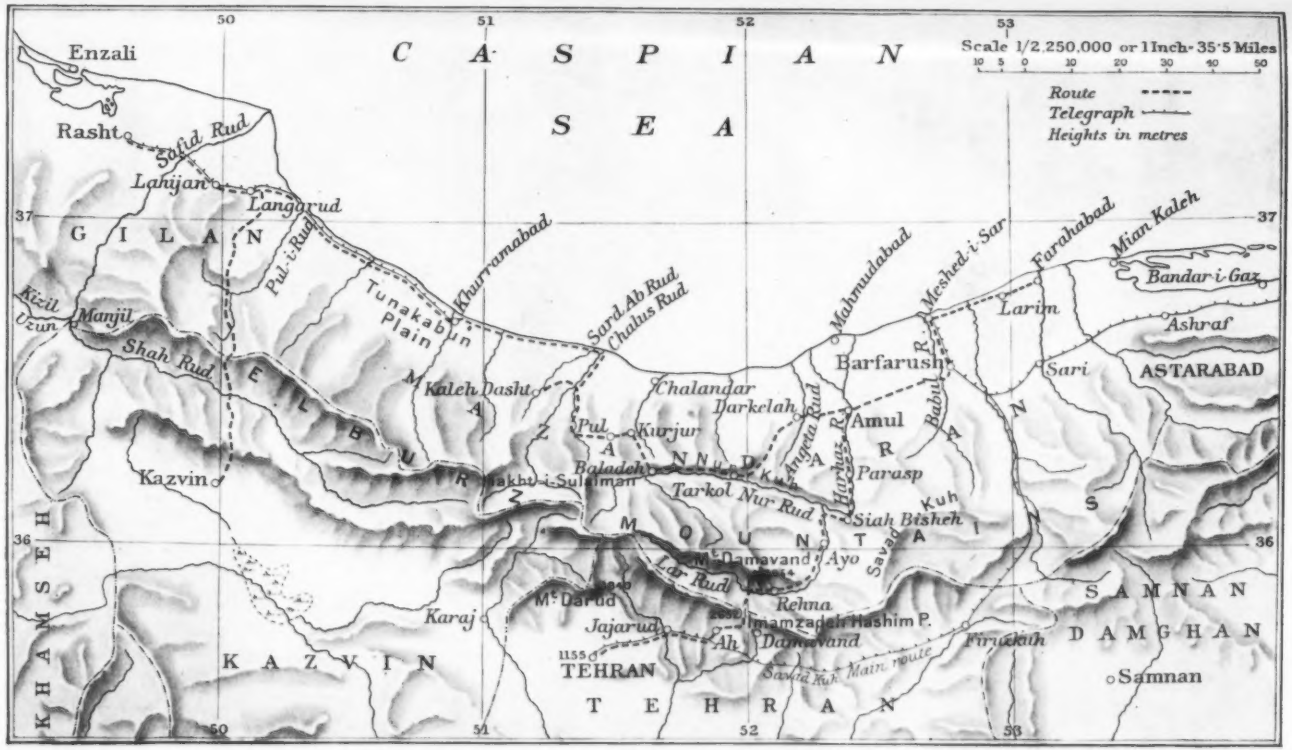
At the confluence of the Nur river the Harhaz bends to the east for some miles, then bends north again and, passing through a gorge, enters the forest region above Parasp. Here, when the inland wind is blowing, one gets the first smell of the strong sea air.

It was unfortunately a little too early in the year to appreciate fully the forest scenery—such a surprise after the bare plateau land of Tehran and the barren valleys of the Elburz—as the foliage was not yet out. Where the river reached the foothills, however, the valley bore a pretty touch of spring, the meadows were carpeted in primroses and long-stalked fragrant violets, with moss and ferns among the rocks. The little town of Amul lies out some 5 miles in the plain, and remains hidden by grass and bush until one stumbles right upon it. It is a picturesque little spot, with its well-built brick houses with tiled and thatched roofs and well-laid-out streets.

From the plateau of Persia and Tehran the Caspian provinces are singularly isolated. The mountain barrier over which, partly through the nonchalance of the people and partly through fear of Russian aggression, no proper roads have been opened, effectually isolates the Caspian provinces, so much so that hitherto they have almost been regarded more as Russian than Persian territory. Indeed the Russians so regarded them, for they monopolized the country. But although monopolizing it, they failed to develop its natural resources; and they also placed a barrier against Persian or foreign enterprise. Here they extorted more, monopolized more than any other part of Persia. How the Persians feared them is exemplified in the story of the little railway from Mahmudadad on the coast to Amul, built by the enterprise of the Persian merchants to tap the wealth of the forest and rice and cotton fields, and intended one day to be extended to the iron ore deposits at Angetarud. The railway, after flourishing awhile, was destroyed by order of the Tehran Government, who feared it might facilitate Russian aggression on the distant capital. A Russian obtained the monopoly of the sturgeon fisheries and caviare making on the Persian shores for a nominal sum, the Prime Minister advising the Shah to give away the rights, saying, "The water of the sea is salted, and the Prophet has taught that the sturgeon fish is unclean food for man, so what use have we for the water and the fish?"

The isolation of the Mazandaran resulted in the central government retaining only a loose control over the people, who prior to 1919 were banded together under the leadership of three principal military officers, Sirdar Jalil, Amir Mokaram, Amir Moayat.

Mazandaran may be divided into two parts: first, the plain occupying the bay of mountains where they recede some 20 miles from the sea; and



SKETCH-MAP OF THE CASPIAN PROVINCES OF PERSIA

where lie the towns of Sari, the capital (20,000 people), Barfarush, the trade centre (40,000), Amul and Ashraf, with the seaports of Mahmudabad, Meshed-i-Sar, and Farahabad; and secondly, the hill district comprising the Nur mountains and valley, Larian (the Harhaz valley) and Savad Kuh. About half the plain—400 square miles—is cleared of forest and cultivated in rice and cotton, the two staple products of the country. Mazandaran is certainly a land of plenty, all food stuffs being exceptionally cheap. The soil is remarkably productive, growing every kind of vegetable, fruit, and flower. One needs to come to Mazandaran in the late spring and summer to see the vegetation at its best, when the fields and gardens sprout and bloom with twice the profusion of the best parts of our own country. But at that time one has to pay a price and support the one bad thing of the land: the summer climate. Typhoid and cholera ravage the population, and malaria takes its steady continuous toll of death. At that time one would prefer to escape from the disease and the steaming insect-invaded atmosphere to the hill districts. The population is divided into two groups also, the plains people and the hill people. The former remain all the year round among their cotton fields and rice swamps, earning a living easily from the productive soil and resting as much as possible in their houses. It is a man's ambition to own a village, and so live a life of ease enjoying the landlord's exorbitant but customary third of the villager's produce, remaining always in his house, eating enormously of rice and drinking enormously of tea. Very different are the hill people, who lead a healthy life in the summer among the mountains, tending their sheep and cattle, and cultivating usually only enough for their own yearly needs. In the winter they migrate to the plains to graze their cattle and earn a wage from the plains people by doing their heavy agricultural and irrigation work for them. The mountaineers are hard working, frank, friendly, and jovial. The plains people are lazy, cringing, and less hospitable.

Perhaps the most remarkable feature of Mazandaran is the forest, some 4000 square miles in area, extending over the plain, where it has not been cleared for cultivation, as an impenetrable thorny bush jungle and reaching inland from the foothills, where the giant oak, beech, and boxwood is found, halfway up to the main chain of the Elburz. The finest forest lies along the western coast, where the mountains approach the sea. The Russians have been cutting timber for years, gratis through lack of forest laws, and have exported much of the valuable boxwood to Europe. Besides the box, which grows to 18 inches in diameter, the beech and oak are the two valuable woods. There are some forty different kinds of wood in Mazandaran.

Another natural resource of the country are the minerals, of which there is evidence of considerable wealth. Petroleum is found near Sari; and it is of such good quality that the people can drain it from the ground and burn it without refinement in crude lamps. Iron, coal, and marble

are found in the Nur district; also lead, sulphur, and mineral and medicinal waters. The value of the minerals and the forests lies in their favourable geographical relation to the commercial needs of Southern Russia and the Middle East, isolated from European sources of supply. Mazandaran needs, however, roads above all things. There is not a road in the country. The narrow paved paths of Shah Abbas have disappeared except for remnants here and there. The only means of travel is by horse, and the only means of transport pack mule or pony. In the summer, when the ground is dry, this may suffice, except for the obvious inefficiency of pack transport compared to wheeled transport; but in the winter the land becomes a bog, and traffic almost ceases. The road from Barfarush to Sari, the most frequented, becomes on that account the worst road in the country. A unique feature of these tracks through the winter mire are what may be named "Mazandaran staircases." The pack-ponies, treading always in the same places, cut the ground out into even corrugations or ridges at right angles across the track with water-filled hollows 2 feet deep between the ridges. Animals of the country are trained to step in the hollows, and so can ascend any slope however steep and slippery, because they walk as if up a staircase. Only the native animals are of any use either for pack or saddle, and it is a mistake to ride any horse not procured locally in the country. Furthermore, the mud is terribly injurious to horses' legs and hoofs. It was found necessary to spend half an hour after every march washing and drying the ponies' legs, and dressing them with red mercury and butter. Mazandaran is a wonderful country for its riches and its scenery, but impenetrable for travellers in winter for its quagmires and staircase roads, and impenetrable in summer for its heat, malaria, and insects. But the spring and autumn the visitor can enjoy to the full.

At Amul, as at Ashraf, Farahabad, and other places, there is much of archæological interest. Amul, destroyed three times in its history by the flooding of the Haraz, stands on the site of one of the oldest cities of Persia. The people bake no bricks for their house-building. They merely dig the soil and extract all the bricks they need. In turning the garden soil bricks and tiles appear, and digging deeper entire buildings are struck. The site of the oldest city is just north of the town. Some years ago the people used to dig regularly for treasure and obtained a good deal. In the centre of the town is the Bagh-i-Shah with the site of an ancient palace surrounded by a moat. The people have a legend of a queen's jewels lost in the sudden destruction of the town by river floods; and each Amuli hopes to strike the treasure one day digging on his property. In the Bagh-i-Shah I myself found a small wall tile covered with old goldleaf.

Amul to Barfarush is one stage; and, after a pleasant sojourn at the former place, we set out to travel east for a short way before proceeding along the Caspian shore to Gilan and Rasht.

Crossing the Babul river by a fine masonry bridge, one follows downstream a short way over staircase and bog and reaches the town of Barfarush, a pretentious place that boasts of its 40,000 inhabitants, its trade, and its leadership of the civilization of the province. A flourishing trade certainly there was at normal times, the town being situated in a convenient position on the caravan track from Tehran to the coast. It collects cotton, which it dispatches by Meshed-i-Sar, the seaport, mainly to Baku, with rice and oranges, fresh and dried fruits. It imports sugar, tea, petroleum, cotton fabrics, clothes, and European commodities. It forwards some of these (but principally rice and dairy produce) to Tehran. Trade with Tehran is seriously hampered by lack of roads. The Savad Kuh cart road, if built, would enormously profit Tehran and all north Persia by allowing the cheap Caspian food stuffs to flow into that country, where food is scarce and dear.

Meshed-i-Sar offers a pretty panorama of thatched cottages, grouped among fruit gardens and greenery along the banks of the Babul river. The Baku steamers anchor outside the port and unload into river craft, as the bar is undredged. Riding along the coast east of Meshed-i-Sar towards the promontory of Mian Kaleh, enclosing the Murdab or lagoon of Bandar-i-Gaz, one traverses alternate marsh and forest; but the best road is the beach, a ribbon of hard sand 50 yards wide along which one can gallop for mile after mile, chasing phantom objects curious and always disappearing in the receding mirage. The ride is broken here and there by the numerous brooks and rivers that empty into the sea. The former rise from the marshes a short way inland, and these, without reconnoitring, one can generally plunge into and ford straight away. But the big rivers that come from the mountains are sometimes too deep to ford. Here horses and mules have to be ferried across in the broad-bottomed boats of the natives. It is 30 miles by the beach from Meshed-i-Sar to Farahabad, the little port that ships the trade of Sari.

For a winter's duck shooting there would be few better places than the marshes, black with duck in the season, along the seaboard; and Larim, situated in the centre of an open plain, which in the spring is a wonderful sight with its square mile of wild scarlet tulips, would be a good shooting centre. A sportsman could come to Mazandaran in the winter (if he will brave the quagmires) for a month's duck shooting, followed by a month's tiger shooting in the forests 40 miles west of Mahmudabad, where the mountains narrow to the coast, and the virgin forests of Chalandar block the way, leaving only a narrow path by which to pass along the beach at the edge of the waves; where the villagers are almost as wild as the forest itself; and where the tigers lurk in the boxwood thickets in the daytime and stroll about openly on the beach in the night-time. In the early spring the sportsman could migrate to the mountains to shoot the Caspian stag, bear, ibex, and moufflon,

driven to low altitudes by the snow. It is only in this eastern, the highest and most rocky, part of the Elburz that the hill shooting can be obtained. The fishing is disappointing, because near the sea the salmon are not of the sporting variety and cannot be fished with a rod. The natives, casting nets in the rivers, haul in half a dozen at each throw, so plentiful are the fish. The mouths of the rivers are trapped; and in the springtime, if the traps were bought off for a month, many salmon would get up to the higher reaches of the rivers, where perhaps they would take a fly. But the buying off of the traps would be a costly proceeding, because the natives catch so many fish of all kinds in them, and make a good profit thereby.

Along the shore are many fishery stations formerly belonging to the Russian Fishery Company, but taken over since the war by the Persian firm of Tomaniantz. Most of the stations, through lying idle after the Russian Revolution, have become gutted and ruined; but at Farahabad, where Tomaniantz have started their first fishing enterprise, fishing and caviare making is in full swing. Turkoman are employed exclusively in the fishing. Sailing along the coast from their own country, they settle on the Persian shores, and hire themselves out to the fishery stations, being paid by royalty on the amount of fish they deliver and the amount of caviare the fish yield. Magnificent fellows are these Turkoman, rough no doubt, but hospitable like all nomads. They invite you readily into their tent shelters, pitched always noticeably apart from the Persian villages, for whose inmates they have no great respect. The Persians of the coast fear the Turkoman because of the fierce raids they have made against them from time to time. But the raids have ceased now since the gendarmes have policed the country and protected the people by establishing posts along the coast. Still the armed gendarmes themselves are chary of arguing with Turkoman unless they are at least three to one against their unarmed visitors. Clever at their work too are these fishermen. They lay out parallel lines at the mouth of the rivers, each line carrying hanging sharpened but unbaited hooks 18 inches apart and about 2 feet deep in the water. The sturgeon, always clumsy fish, get caught by the sharp hooks as they swim upstream; and so successful is the method that each fishery station collects up to two hundred of these immense fish in a day. The Turkoman complain of losing many of their plain hooks, from which the fish can sometimes escape. They call the barbed hooks "English hooks," and lament not being able to get these any longer.

At the port of Farahabad there is only the fishery, the police post, the customs house, and the houses of some Armenians engaged in a commission agency for cotton and rice. But a little way up the river is a site of the ancient palace of Shah Abbas, commanding a bend of the river. A good deal of it still stands, and from the remains one can reconstruct in one's mind the stately form and the fine interior decorations of this

TARKOL, NUR VALLEY

BALADEH

MAIN CHAIN OF THE ELBURZ FROM THE NUR RIDGE

MESHED-I-SAR

mediæval stronghold. The domed ceilings still bear traces of their plaster and tile ornamentation. One side of the palace is vertical to the water's edge, and on the other one looks out to what must have been a beautiful walled Persian garden. Near by are other ruins, and further up the river is the present village of Farahabad.

The ride along the coast as far as this point was sufficient for a reconnaissance of the seaboard, and the inspection of the two most important seaports, for the country is uniform in character—a straight line of beach with adjacent sand dunes, coastal marshes, and further inland forest, cleared here and there for cultivation. So at Farahabad we turned back, following the same route to Amul, whence the plan was to travel west by an inland route through the mountains parallel with the coast. A noticeable feature of the Elburz is that many of its rivers do not flow straight to the plateau on the one side and to the sea on the other, but they cut long straight valleys parallel for a considerable distance with the watershed, finally breaking away to the plateau or to the sea through defiles at a sharp turn. Such a valley is that of the Nur river. One can follow the Nur valley, afterwards crossing into the Pul valley, and traverse a considerable length of the mountains by a more or less level route without the switchback work that such a longitudinal traverse of mountains would ordinarily entail. Other such valleys, splitting the mountains parallel with their length, are the Shah Rud, the Kizil Uzun, the Pul-i-Rud, and the Jaja Rud.

Travelling west from Amul, one crosses after a few miles into the Nur province, which comprises the western end of the Mazandaran plain covered with dense forests and the Nur valley, a rugged treeless region between the coastal forest and the main mountain range. From the hidden villages of the forest plain one can look straight up to the snow-covered Nur ridge 8000 feet above. Many narrow ravines lead down from the ridge to the sea. The one we took, by which to cross to the Nur valley, was too narrow to allow of a road. The ponies had to pick their way for the most part up the river-bed, travelling at an early hour to avoid the swelling of the torrent from the melting of the snow. Difficult as it was, this river-bed was the main caravan route from the Nur province *viâ* Baladeh to Tehran, even shorter than the Harhaz route, but considerably more difficult. It is astounding the ground the hill ponies can tackle with 200-lb. loads on their backs.

At Darkelah the aged Governor of Nur offers hospitality to all who visit his province. One can find much of interest in the surroundings. A day was spent in shooting pig, another in visiting Angetarud and Awuzkoti, where the natives smelt the iron ore in charcoal furnaces, and another was given up to photography. The views round Darkelah were the prettiest yet seen, particularly in the evening. One needed paints and paper rather than a camera to catch the colourings of the forest, bursting into spring greenery, the picturesque cottages of odd fanciful shapes,

leaning walls, and too big conical thatched roofs that sit on them like huge snuffers on a candle. The orange trees, peach, pear, and mulberry blossoms, the forest clearings and ricefields, where the villagers laboriously cultivate by day and the wild pigs as systematically destroy by night. The mountain wall overshadows the plain, rising 8000 feet into the realms of snow. The heavy, moist atmosphere subdues the detail of the forested slopes and dark ravines, and diffuses over the mountain background a delicate mauve-purple glow. Comparing this country with others, one might say it resembled a little the foothills of the Terai, seen in a September atmosphere at a break in the monsoon, combined with a touch of the colourings and blossoms of a garden in Japan.

The Nur ridge holds much iron ore, and one is struck by the economic possibilities when one looks back to the north. There is the sea, so close, with its shores stretching to the horizon east and west, lapping the foot of these mountains rich in minerals. The sea offers communication with the markets of the Middle East and Southern Russia. With the iron there is also coal. The only physical obstacle to mining would be the belt of forest and mountain valley between the coast and the actual location of the minerals, rather high up on the ridge. The sites of primitive native furnaces are seen in the valleys. The ore was collected from the river-beds, and smelted laboriously with charcoal to make shot and musket-balls; but now this industry has almost ceased, since the natives are allowed weapons no longer.

The ascent to the Nur ridge illustrates the rapid changes of climate and contrasts of scenery that travel in this coastal country entails. In two days you emerge from steaming malarious forests into frosty winds and snow, and change from forest scenery into the treeless landscape of the plateau once more. There are some pretty villages, however, in this otherwise desolate valley of Nur. Tarkol, the summer residence of the governor, stands terraced on the hill by the banks of the mountain brook, flowing through fruit gardens and cypress trees. Baladen, a day's march farther on, is a larger and even prettier village than Tarkol, and possesses an extensive bazaar, open in the summer months. One can climb up to the ancient watch tower on the cliff and get a good picture of the bazaar, with its houses worked one into another like cells of a honeycomb all under the same mud crust of a roof. The valley broadens at Baladeh, allowing space for fields and gardens. The river is wide and rippling before it wriggles through its gorge a mile below, the gateway from the Nur ravine to the Baladeh plain. The Elburz surrounds the place with a gaunt wall of mountains that hold the clouds blowing over from the sea. The weather here is unfortunately more often bad than good. From Baladeh radiate caravan routes over the mountains to Tehran, to the Chalus valley, to the Pul valley, and over the Nur ridge to Kurjur in the province of Tunakabun. We took the latter road, and in one day's ride crossed over to Kurjur.

Tunakabun is a smaller province than either Mazandaran or Gilan, and lies between them. It is less accessible than either the other two, as there are no good seaports and only one road, the Chalus, to communicate with Tehran. The chief town is Khurramabad in the fertile delta, called the Tunakabun plain, small compared with the plains of Mazandaran and Gilan, but nevertheless the most intensively cultivated and thickly populated part of the whole Persian Caspian coast. The cultivation is rice. In the mountains are three grain-growing districts, comparatively small also, but still so intensively cultivated that they merit being called "the granary of the Caspian Provinces." These districts of Kurjur, Pul, and Kaleh Dasht are a peculiar feature of the mountains. The valleys beneath the main range broaden out into alluvial plains at an elevation of 4000 to 5000 feet, with an area from 15 to 20 square miles. The rivers, or what is left of them after irrigating the barley-fields, continue to the sea through ravines. The province is owned almost entirely by Sipa Salar, that rich and powerful landlord who has played such an important part in recent Persian politics under his old title of Sipahdar. Sipa Salar now, however, has no military power. The Gendarmerie have disarmed the people, although not so completely as in the case of Mazandaran.

The scenery of Kurjur and Pul is not so interesting. There is no forest, and no trees except planted fruit. The terrain is one huge barley-field. Kaleh Dasht, however, reached by following down the Pul valley and crossing the deep Chalus valley, is much more interesting. Kaleh Dasht is unique. It is one of the beauty spots of Persia. It used to be the favourite hunting-ground of Nasir-ud-Din Shah, that sportsman who had a 9-foot cobbled mule road built over the Elburz so that he could come to Kaleh Dasht each year to shoot ibex, accompanied by his entire harem and the myriad retainers of the Royal Persian Palace. The plain of Kaleh Dasht, some 20 square miles in extent, is surrounded by forest and hills. To the north the ravine of the Sardab Rud leads up through pretty Alpine scenery to the foot of Tak-i-Sulaiman (height 14,000 approximately), outstandingly the second highest mountain of the Elburz; it forms the central knot, wherefrom the Nur and Lar rivers radiate to the east, the Shab Rud to the west, and the straight-flowing Chalus to the north. The mountain has a fine aspect and climbing attraction from Kaleh Dasht. From the Shah Rud, however, it is uninteresting. The plain of Kaleh Dasht is dotted with picturesque villages, whose cottages resemble Swiss chalets rather than the usual mud plaster dwellings of the Persian hill village. Fruit and walnut trees abound. This district would be excellent for establishing a textile industry which, together with the exploitation of the minerals, would be the most profitable development of enterprise in the Caspian provinces. At the present time the country produces only raw materials; and all finished products are even at normal times inordinately expensive, because there is no direct trade. All trade passes indirectly through commission agencies in Russia and the

Caucasus. Raw cotton is cheap, but a reel of cotton costs three times its European price. Cotton spinning in this country would succeed because of the raw material being at the factory door, the labour being cheap, and the markets extending to the whole Middle East and Southern Russia and Turkestan. The advantages of selecting Kaleh Dasht as the site for the factory would be the salubrity of the climate, the better work obtained from the hill people than from the plains people, and the facilities for water power.

The natives of Kaleh Dasht are a tribe that originally was brought over from Kermanshah; but it is so long ago now that they have lost their tribal characteristics, and have settled on the land, mixing with the indigenous population. Besides their barley cultivation and their sheep and cattle, they breed ponies, and the women weave carpets, but the quality is more on the level of the Caucasian than of the Persian carpet. This is the only district in which there is any carpet weaving in the Caspian Provinces, although, of course, the Turkoman country near Astarabad, famous for the beautiful Turkoman carpets, is not far distant.

It is only a day's march from Kaleh Dasht to the coast. One follows the Chalus road; and a few miles below the Chalus bridge one plunges into the coastal forest once more. At the mouth of the Chalus, when the mountains have come within 2 miles of the sea, there is a bazaar where the caravan road ends, and where the charvadars meet and exchange goods with the traders, who bring merchandise by sea from Baku. Here are also orange gardens belonging to Sipah Salar. The place was the site of a forty days' battle between the Kurjuri raiders and the people of Tunakabun—not so dreadful as it may sound, for the warriors remained in trenches and only five casualties occurred. No great fighters are these Persians, although they parade on ponies with a proud display of cartridge belts and obsolete rifles. The Gendarmerie are mostly recruited from the stout tribes of Azerbaijan. The Turkoman and Kurds are the best of the lot.

The Chalus road ceases at the bazaar; but many of the mule caravans continue their journey to Tunakabun, where they fetch rice to bring back to Tehran. The forest is impenetrable. The beach is their only road. But here the ride along the beach is bad going over soft sand and shingle—a contrast to the beach of the Mazandaran plain, which is good and hard enough to make an aviation ground. Fishery stations are found along the coast; but, as in Mazandaran, they are now ruined through six years of war, stagnation, and desertion. One finds also dumps of timber, oak planks, and boxwood logs, cut from the mountain forests and stacked, but still remaining on the beach waiting to be carried away.

It is tiring riding along the soft sandy path between the forest wall and the sea; and now in April the temperature is rising and the heavy air induces lassitude in horse and man alike. Since descending from the mountains one notices each day a diminution of the powers of the body accompanied

HOUSES OF MAZANDARAN

THE PLAIN OF TUNAKABUN

KALEH DASHT

TAKHT-I-SULAIMAN FROM KALEH DASHT

also by a torpidity of mind, and can understand how the climate depresses the inhabitants, who have to support it year in and year out; and one condemns them less for shirking work, sleeping the day in their houses, and hiring the labour of the hillmen to do the heavy work of the fields. Eighty per cent. of the adult population are habitual opium smokers.

At the Tunakabun plain, generally called "Tunakabun" simply, the mountains recede from the sea, the forest is entirely cleared, and the delta plain is covered with innumerable villages among ricefields. We turned off from the beach at right angles by the first metalled carriage road yet met, and rode along its embankment through the inundations into Khurramabad. The ride had been 30 miles that day, and Khurramabad was not reached until nightfall. That evening there was one of those typical vivid sunsets that one sees after rain in these parts. The air is still. The violent haze of the twilight tones the shadowed forests of the lower slopes to a leaden blue, while the snow-capped summits glow with the last red fire of the sun. All around are the flooded ricefields with their perfectly tranquil silvery surfaces reflecting the rose of the sky and gathering the mauve shadows of the trees and island villages. Over these swamps the air is hot, damp, and still.

In Khurramabad we stayed with the nephew of Sipah Salar, who was living in his house as manager of the estate during his uncle's absence; and a few days of his hospitality came as a pleasant rest after the riding of the last week from the mountains of Kujur and Kaleh Dasht. European society afforded a welcome change for our host too, entirely dissatisfied but resigned to his life of ennui at Khurramabad. But in this perhaps he was no different from most Persian gentlemen, pleasure loving, courteous, hospitable, witty and intelligent, overeating and entirely indolent. There is one serious topic, however, which always interests them: the future prospects of their country. A characteristic, emphasized since the war, is the resigned attitude Persians adopt towards corruption and disorganization. They mistrust one another in matters of integrity and public honour. Intrigue seems also to rule domestic as much as public life. But with all their inability to help themselves, they are animated by a sincere desire to see their country put in order, for they are ever a proud people, proud of their empire for its past greatness, proud of the fairness of their skin as a mark of racial superiority over their Eastern neighbours, and proud of their culture and polished manners. With all the Persians we met, we found that the future of Persia was always a vital and absorbing topic of conversation for them, and one on which they never tired of asking questions. Now that the war is over they look to the Western nations to help them to organize their country for they frankly recognize they cannot do it by themselves. And of all people the British are trusted the most, although individually the French may be preferred from a social point of view. But they want help only, not ruling.

Another strip of forested land, narrowing to 2 or 3 miles, separates the Tunakabun from the plain of Gilan. But one can cover half the distance by an inland route and escape the monotonous sand of the beach. The scenery is ever the same, forest, boxwood thicket, forest-smothered villages, rice swamps, river after river to ford, quagmires of mud and bog after rain. On crossing the border into Gilan the track takes to the beach, and so, in order to escape the monotony and also being pressed for time, we combined the last two stages into one and rode 42 miles into Langarud in a day, the baggage following on the morrow. At Langarud one reaches more or less well-known and mapped country once more, the province of Gilan being the best known of the Caspian provinces, as the Russian road from Enzali to Tehran passes through it. The province was considerably Russianized, European buildings being found in the towns. Also a good map has been compiled by Rabino.

After visiting the towns of Langarud and Lahijan we went into Rasht, and thence back to the Safid Rud to float down the river in a native boat to the mouth, where the important Russian fishery station is situated. The river has a changing course, and there is not sufficient gradient to enable water to be drawn off for irrigation, so there is little cultivation and few villages in this stretch of country, only forest. The fishery station was one of the biggest belonging to the Russian Company, built at great cost and equipped with tramways, ice plant, and electric light; but the changing of the river-bed in 1914, together with the advent of the war, put an end to work. Tomaniantz took over the place, and ran it on a small scale after the war. The caviare season is from the middle of March to the middle of June, when the sturgeon come up the river to spawn in enormous numbers. Each of these immense fish yields up to 10 lbs. of roe. The caviare is prepared in the following way: the roe, after washing, is mixed in a barrel of hot brine for ten minutes, then drained and packed in a sack. The roe, thus swollen and softened by the hot water and salted for preservation, is then squeezed in a hand press into a congealed sticky mass. In this condition it is left, still in the sack, for a few hours, after which it becomes solidified, and changes in colour from green to black. It is then finished and ready, and, emptied from the sack, it is packed in barrels ready for transport to Russia. The fish, after cleaning, are salted and despatched to Krasnovodsk.

Here at the mouth of the Safid Rud, close to Enzali, our reconnaissance duties were completed, so we set out to return to Kazvin, not by the military road by Rasht and the Safid Rud valley, but by a more direct route through Langarud, straight over the mountains, making a ride of 100 miles. The mountains in this western end of the Elburz are comparatively low and rounded. One can cross the ridges, first into the Shah Rud valley, and then over to the Kazvin plateau, almost anywhere, as there are tracks in all directions. The passes are about 7000 feet high. On leaving Langarud one traverses forested valleys until reaching the open

Chak Rud valley, the barley-growing district of Gilan. It is all switch-back work, ascending ridges and crossing valleys at right angles. The deepest gulf is that of the Shah Rud, the river being little above sea-level. Riding from day to day Kazvin was reached at the end of May; and here we heard for the first time the astonishing news of the Bolshevik landing on the coast near Enzali, where we ourselves had been only a few days previously.

One must hope that peace and order will come again to the Caspian country, for it is well worth development. Russian aggression must be checked, communications and roads must be made, the land and sea policed, and the natural riches of the land developed. Then the Caspian provinces will prove their value to Persia by contributing foreign export trade and internal food supply—economic contributions which are both vital for the rebuilding of the country.

Before the paper the PRESIDENT said: The lecturer this evening is not a stranger to us, for about two years ago he gave us a lecture on the approaches to Mount Everest, and he then revived the idea which had been dormant during the time of the war, of an expedition to ascend this highest mountain in the world. He was giving us an account of his experiences on a short reconnaissance from Sikkim in the direction of Mount Everest, and after his lecture there was a most interesting discussion in which our late President, and ex-President also of the Alpine Club, Mr. Freshfield, took part, and Dr. Kellas who has made many high Himalayan ascents also spoke, as well as Captain Farrar, the then President of the Alpine Club, who promised on behalf of the Alpine Club unstinted support towards this proposal. I also spoke on that occasion, and I remember I said that the chief obstacle in the way of any expedition to Mount Everest lay first of all in our own Government.

[*The President then related the receipt of permission from the Government of India and from the Dalai Lama of Tibet for the despatch of the Mount Everest Expedition, and described the steps which had at once been taken to organize the expedition, which have been published in the 'Journal'; he then proceeded:*—]

Now we must get away from the neighbourhood of Everest and transfer our attention to the shores of the Caspian Sea. I will ask Captain Noel to read his paper on the Persian provinces of the Caspian Sea.

Captain Noel then read the paper printed above, and a discussion followed.

Brig.-General Sir PERCY SYKES: We have listened to an extremely interesting lecture, and we have seen excellent pictures. I feel quite sure that Captain Noel has also contributed an equally valuable addition to our geographical knowledge of that part of Persia. Before this, on our latest map, there was sketchy work more or less put down from hearsay. Now in the future we shall have some main roads and a good deal of cross-country work also set down. On my first journey in Persia twenty-eight years ago I started from Astrabad bay, a little to the east of where Captain Noel was, and I can sympathize with all he said about the mud and difficulties of travelling. I was there in mid-winter, and I recollect my greatest difficulty when riding was keeping my feet out of the mud. The Caspian Provinces give a remarkable instance of the influence of rainfall on history. The rainfall there is very heavy,

it has cut these extremely deep gorges, and below is all mud and forest, with the result that these provinces have been extremely difficult to subdue. In the seventh century, when the Arabs conquered Persia, they took over the rest of Persia without any trouble, but could not take the Caspian Provinces, and for 120 years longer they remained independent, and would have continued so much longer but the members of the ruling family quarrelled among themselves. One famous English traveller, Jonas Hanway, visited this part of the world about 180 years ago with the idea of trading across Russia with Persia. He landed at Astrabad bay, went to Astrabad, and came into one of those nasty little revolutions. They took all his goods and wanted to make him a slave; but he was let off, and then went right along the shore of the Caspian to Resht, and had a most terribly bad time with no clothes or supplies, all having been taken by the rebels. He went to Nader Shah, who was in camp near Hamadan, and obtained an order for the restitution of his property, came back with it, and saw the terrible punishment meted out to the rebels. Pillars of plaster had been built and had been decorated with the skulls of the rebels, and in his book published in 1753, 'An Historical Account of British Trade over the Caspian,' there is an illustration. One result of that journey is remarkable. Hanway had been in the country where, as Captain Noel has said, it is always raining, and when he came back to England he had a very bright idea, and introduced the umbrella to England. In England, perhaps, Hanway is celebrated for having introduced the umbrella. In Persia we regard him as one of our great Persian travellers.

The PRESIDENT: We are very glad indeed to congratulate Sir Charles Yatè on the honour of Baronetcy, and we shall be very glad if he will speak.

Colonel Sir CHARLES YATE, M.P.: Like Sir Percy Sykes, I entered the Caspian Provinces from the east, from Astrabad, and I never had the opportunity of going through Mazandaran and Gilan, of which our lecturer has given us such a very illuminating account this evening. I agree with Captain Noel in emphasizing the importance to Persia of these two provinces. He has told us of the mineral and other wealth to be got from them, and, as he told us, one of the saddest facts for Persia, viz. that the whole of that country has been entirely monopolized by Russia. Naturally in such a mountainous district there are no easy roads communicating with Tehran and the rest of Persia, but these, I hope, will come in time. I quite sympathize with all you have heard described of the mud there, for I travelled down to the coast through the mud to embark on a Russian steamer there, and I remember it well. Mules when they travel along there all walk in the same step that the others have taken before them and put their feet from one hole into another, and the road is thus one succession of mud-holes. Now the contrasts along the southern shores of the Caspian are the most extraordinary I think I ever saw. I was there in the winter—in December—and the mountains come down near Astrabad very close to the sea. A few hundred feet up the whole mountains were a mass of snow, and yet along the shores of the Caspian just below the oaks and other trees were all in full leaf; bracken, brambles, and rose-bushes were all in full flower; and hawthorns both in flower and berry. The heat was great riding along in the sun at midday, although the snow looked as if you could touch it almost above you. The country is a wonderful one in the way of shooting. At Astrabad woodcock are the great sport. I could go out of my tent and shoot half a dozen woodcock almost at any time. You also saw them coming flighting in from the hills at dusk to get into the gardens round the town of Astrabad, and it took a good shot to kill them then. I can absolutely support all that

was said about the number of wild pigs in the country. I could not understand at first how it was that the trees along the roadside were full of pigs' heads, and eventually I found that this was the way which the guardians of the cultivated ground used to show how successfully they did their work. They were like our mole-catchers here. In that country you found pigs' heads stuck up in the trees just as mole-catchers here stick up the moles they have caught on the nearest hedge. I did not see any of the great Caspian stags the lecturer has told us about, but I got some good specimens of their horns. The Caspian Sea, as you know, has been entirely dominated up to now by the Russians. Under the treaty of Turkomanshai the Persians were forbidden to have any vessels on the sea. The only vessel which the Russians allowed the Persian flag to be flown on was the Shah's yacht. That was the only Persian vessel they allowed on the Caspian. The shores were dominated by the two or three little Russian men-of-war that went all round and kept order, and they monopolized all the trade. There were, too, Russian fishery stations all along the shores of the Caspian, and in fact everything was Russian. We had a chance a short time ago of altering this when, you all will remember, a British force of naval men went up all the way from Basra through Baghdad to Resht and Enzali and eventually formed an excellent fleet on the Caspian under Commander Norrie. That little force of British sailors did wonders on the Caspian. I remember bringing the scheme to the notice of the Government. I said, "Just look what we have done in East Africa. Look at Tanganyika. There we sent a small naval force, with boats in sections, and were able with those boats to sink all the German ships on that lake." I said the same thing could be done in the Caspian. It was done. We got a big gun on the Caspian; we eventually acquired the ships on the Caspian; and we could have dominated the Caspian to the present day had we held on. Unfortunately those ships were subsequently handed over to General Denikin, and the Bolshevists now have possession of all those ships. They are thus able to dominate Enzali and Resht, and are now threatening our own forces at Kazvin, and when that small British force is withdrawn will certainly threaten and possibly take Tehran.

The PRESIDENT: I was very interested to hear from the lecturer that the first to visit the part which he described was J. B. Fraser—that is, James Baillie Fraser, who was a member of the Council of our Society in the thirties, one of our very first Councils. He was a remarkable member, an East India merchant who gave up his interest in business and made some very fine journeys in the Himalayas, which were then almost unknown. He was a considerable artist, and painted some excellent pictures of the Himalayas, which at that time were thought not to exceed 17,000 or 18,000 feet in height. They were almost unknown in those days, and these pictures he had reproduced in England at great expense. From the Himalayas he went to Persia. He wrote two interesting romances about Persia, but I did not know until this evening that he had travelled in these provinces of Persia of which we have had such a delightful description to-night. We are very glad to hear of him again, to hear of one of the first members of Council of our own Society. I think many of us have been surprised to hear from the lecturer what a very rich country there is along the borders of the Caspian Sea. His reconnaissance is very valuable, and we are very glad he put his military notebook into his pocket and took his camera and gave us those most beautiful photographs which we have seen this evening. When one hears from him of the Persians there being so hospitable and so anxious to have help from us, and when one

sees officers like Captain Noel, of whom there are hundreds in this country only too anxious to give the very kind of help these Persians need, we do hope it will be possible that we should come together, that we should give the Persians the help that they need. As Sir Charles Yate has said, it depends entirely upon themselves. If they have the wisdom to ask for that help, there it is forthcoming, and we certainly hope that the decision they make will be that they shall ask us for that help, and we shall be able to revive that wonderful country, and make it blossom forth as we have seen from the lecturer is possible. I am sure on your behalf you would like me to thank the lecturer for his most interesting account and his admirable photographs.

THE SCENERY OF GREECE

A. W. Gomme

Read at the Meeting of the Society, 4 April 1921.

YOU have probably before now listened to amateurs who, coming forward to address you, begin by apologizing for being amateurs. But there is a special reason for an apology in my case, for not only am I not a geographer, I am not even a traveller. I have been to no distant countries nor unknown shores. I have wandered a good deal about Greece (though I should hesitate to confess how much of that country I have still to visit), nothing else; and if I nevertheless venture to speak before you, it is—well, chiefly because the honour of an invitation from this Society could, obviously, not be refused. But in addition I have been encouraged by reading the address which your President gave at the anniversary meeting last year. In that address he suggested that "the characteristic of the face and features of the Earth most worth learning about, knowing, and understanding is their beauty; and that knowledge of their beauty may be legitimately included within the scope of geographical knowledge." It is important to compare the beauty of one country with that of another; and if I cannot discover for you either "a new region which possesses special beauty or a new beauty in a region already well known," and if I am certainly not the poet or painter which Sir Francis Younghusband rightly required, yet my words may be taken as an obligato, as it were, to the exhibition of lantern slides which you will see, many of them of quite exceptional merit, and to that still difficult task I will address myself.

I was encouraged, as I say, as I read Sir Francis' paper—until I came to the last page, where he says: "this (the description of the beauty of the Himalaya) that we want of the greatest natural feature of the Earth is only typical of what this Society should require in regard to all Earth's other features in order to make our geography complete. As men have pictured the loveliness of England, the fairness of France, the brilliance of Greece, so we want them to picture the spaciousness of Arabia, the

luxuriance of Brazil, and the sublimity of the Himalaya." Greece, then, has already been done. But, fortunately for me, I quarrel with the word "brilliance"; and I shall try to-night to explain why. The task of analyzing and describing the beauty of a country as opposed to recounting its features is, I suppose, analogous to that of the critic of literature or art who seeks to explain the æsthetic effect intended and produced by a poem or a picture, as opposed to one who gives an historical account of artists and poets and their methods. It may be equally fruitful of good in the right hands, and is certainly equally dangerous and open to facile rhapsodizing and shallow generalization.

When I speak of Greece I mean, by the way, that part of the modern kingdom which lies south of Mount Olympus, including of course the Ægean, but excluding Macedonia and Thrace. For this region, corresponding nearly both to modern Greece before the Balkan wars of 1912–13 and to the lands of the classical Greeks, has a common quality which marks it off and separates it from all others. But before touching on this common quality, I wish first to speak of and emphasize what I think is too often ignored in the scenery of Greece, namely its variety. Leaving on one side the smaller variety that is naturally found as you pass from one village to another, or ascend a hill slope and go down its other side, you can divide the country into four or five districts each with marked characteristics of its own. There are, for instance, the onian Islands, there is north-western Greece, the great inland plains, western Peloponnese, and finally eastern Peloponnese, Attica, and the islands of the Ægean. I will say a little about each district in turn, asking you to bear in mind that in drawing, as I hope, the characteristic outline of each I must necessarily omit the multitude of details, the inner modelling, as it were, that go to make up the rich content of the whole.

Of the Ionian Islands I shall say least. I have no good pictures; if I had, they would not give you a very satisfactory idea of the country; and these islands—excluding Ithaca, the very Greek home of Odysseus—but Corfu, Leucas, Cephalonia, and Zante—these four share less than any other part of the country in the common quality of scenery that distinguishes Greece from the rest of Europe. As in politics and in culture, in ancient times and during the Turkish ascendency, so in the nature of their scenery these islands stand apart. In the later period, when they escaped the Turk and were ruled by Venice, they had more associations with the West than with Greece, and the Italian-looking houses of their capital towns still recall the old Venetian ascendency. But in natural scenery they are no halfway house between Greece and Italy, but have a character of their own, an abundance, a Southern luxuriance which is not Italian, and is yet quite foreign to Greece, a quality which has made them so much liked by those unhappy men who get no pleasure from the austerity of Attica and the Argolid. Beautiful these islands are, but almost of a different world from the islands of the Ægean. Here it is not

the confines of the picture which delight, a wide stretch of country and the distant outline of mountains, but the manifold contents of the foreground—grass, flowers, trees, streams, rich cactus hedges; except in one view, that to the east over the sea to the opposite mountains of the mainland, high, exceptionally bare, steep-to down to the water's edge, turning from grey to orange and purple as the sun sets. There in Epirus is the true Greek land, not here in the rich isolation of Corfu.

The inland plains are but three in number, but being of great extent are an important feature in the scenery. They are Thessaly, Bœotia, and the plain of Tripolis in Arcadia. They are alike both in outward appearance and in geological formation, being the floors, I believe, of former lakes, enclosed by a mountain barrier, with no natural outlet for their waters, which in the case of the first two are of an abundance rare in Greece. To-day most but not all of the waters of Thessaly are carried off by the Peneus river through the famous Vale of Tempe; but in the eastern plain the level of the ground slopes gradually downward away from the Peneus bed, and a lake regularly forms in the south-east corner. In Bœotia the Copais lake has been artificially drained in recent years and is now cultivated; while in the plain of Tripolis the waters find a precarious and changeable outlet in natural tunnels in the limestone formation of the surrounding mountains.

As you would expect, therefore, these plains are heavy of soil, often waterlogged, as flat as the fens, and, in a country where ditches, hedges, and trees in hedges are unknown, of a great monotony, which is broken only by the trees that are to be found in the comparatively rare villages and along the banks of rivers. These plains are the chief wheat-growing districts of Greece, and consequently in winter and spring you have an expanse of green while the corn is yet young, in June an expanse of yellow ripening corn, and after that nothing but stubble or ploughland till November sees the green reappear. The monotony is not, of course, nearly so vast as that of the plains of Roumania, but it is of the same kind except for this one all-important circumstance—the line of mountains and hills which surround the plains, which are large only for Greece, so that in the centre of the flattest land you are never far from the mountains that are the frame of any picture in Greece. A plain from which you can see Mount Olympus can never be entirely dull. But, as if to declare that large and rich plains are hardly proper to a land of mountains and stony valleys, you find, especially in Thessaly, what is most foreign to Greece—a thick atmosphere, so that often in summer mountains not 15 miles away will show no inner details such as are the delight of travellers in Greece, and but a hazy outline. The geographer Philippson tells us that when he was crossing Mount Othrys, the range that bounds Thessaly on the south, his guide, who was a Peloponnesian and had never before been in northern Greece, as they suddenly found themselves, more than 3000 feet up, overlooking the whole plain of Larissa, exclaimed, like the followers of

Xenophon at the sight of the Black Sea, "Thalassa, Thalassa!" If he saw it on a day of heavy atmosphere in the plain, this is just the appearance that would present itself from above. And so rare are plains in Greece, that this inhabitant of the Peloponnese could not believe in the existence of a flat piece of land some 40 miles by 20 in extent.

A third district, with a character the very opposite of that of the plains, is north-west Greece, comprising practically the province of Ætolia and the whole range of Pindus. This is a land generally of high and bold limestone mountains, well watered with many streams and some considerable rivers, which run through remarkable gorges, well wooded, and with fewer patches of cultivable ground than any other part of Greece. It is not arid, bare, and stony like the eastern districts, but, except about the lake of Agrinion, it has hardly any level land. Its characteristic tree is not the pine, but the fir; and more to the north, the oak and beech. The cherry, the plum, and the apple are grown, not olive-trees. No carriage road runs across it from west to east, nor has ever done. It is an untamed and most beautiful land, whose inhabitants, mostly shepherds and woodsmen, lead an independent life apart from the rest of the country, just as did the Ætolians of old, down in the villages in the narrow valleys in winter, up on the tops of the mountains with their flocks in summer. There is much variety of scenery, and the paths take you now steeply up a wooded mountain-side, now in a small cultivated valley, now along a narrow ledge cut out of the shaly hill-side or through a narrow gorge with high overhanging cliffs, with many streams and springs and an ever-changing view, and very rare villages. One path goes for a whole day's journey above the 5000-feet level; once I was surprised, after much climbing up and down, by a level stretch for about 3 miles (we were 3000 feet up), and with sandy soil, covered with grass, bracken, an occasional wheatfield, and copses of fir trees; except for the distant peaks and the blue sky it might have been a northern land. At the end of July, when the harvest elsewhere has all been gathered in, even in Thessaly where the winters are cold, the corn is still green; and when you stop for a rest at noon, though there is no cloud in the sky, you are glad to sit in the sun. The proper qualities of Ætolia and the Pindus are boldness and splendour; the boldness of cliffs and high mountain land and deep valleys, and great views from high and commanding points; while everything is fresh in a well-watered land.

Western Peloponnese, the fourth of the five districts into which I have very roughly divided Greece, is also a well-watered country, but of a very different aspect. Here the dominating lines are horizontal, not vertical. It is hilly country, very hilly; but you need climb but a short way, some 200 or 300 feet only, and you have a broad sweep of country before you. The lower valley of the Alpheus, after it has left the gorges of its upper course, is typical, and Olympia is its centre—the most beautiful spot in all Greece, Dionysius of Halicarnassus called it, where Greeks from all over

the Mediterranean collected every four years for the festival, as a mark of union and brotherhood, the one place and time at which they did not quarrel with each other. From hills behind the sanctuary you can see up the wide river valley as far as the distant mountains of Arcadia. The nearer hills are covered with a peculiar, very light-coloured soil—remember that it is remarkable in Greece to find hills covered by soil, except the very thin soil that will support the pine or prickly oak—and on them grow a dense abundance of shrubs, bay and myrtle, and pine trees; below are the vineyards, and everywhere the ground is carpeted, in spring, with flowers, hyacinth, orchid, and anemone; a paradise among lands. What distinguishes western Peloponnese from eastern is, roughly, its greater rainfall and abundance of water, a depth of soil unknown elsewhere in Greece, and the great distance of the high limestone mountains from the seashore, so that there is a long stretch of what the Germans call *Schollenland* between the mountains and the sea, a rolling country of hills, often steep hills, but, as I said, all covered with soil, hence with gentle outlines, and the whole having a horizontal, wide-spreading appearance. It is the country of the currant. As you know, this particular form of grape, just as it is only eaten by English-speaking peoples, so it only grows in Greece (or practically so; it is now cultivated to some extent in Australia). But it also only grows in certain well-defined parts of Greece, namely along the southern shore of the Corinthian Gulf, all down western Peloponnese as far as Messenia, and in the island of Zante; nowhere else, not in inland or eastern valleys where the common vine and the olive flourish. This southern shore of the Gulf of Corinth belongs then culturally, as also I believe geologically, to western Peloponnese; but it is so narrow a strip of cultivable land, and the mountains slope down so steeply and so close to the shore-line, that in its scenery it is quite different, and belongs to a particular district with a character all its own, the Gulf of Corinth and its shores. On the north, except in a few places, such as the small and delightful bay of Vitrinitsa and Itea, backed by the olive-covered plain of Amphissa which retreats up into the mountains and the great pass by which goes the road to Bralo and the north—except in such places, the mountains come down bare and forbidding to the sea. On the southern shore is this rich strip of flat land, very green, with white villages and towns; behind are steep but cultivated hills, marked everywhere with slender dark lines of cypress trees; the whole backed by the mountains of the Peloponnese, broken here and there by romantic gorges down which rivers pour their destructive waters and spread themselves into a broad waste of stones as they cross the narrow belt of flat land between the mountains and the sea.

If you go from Olympia across Arcadia to the Argolid, you realize quickly the difference between western and eastern Greece. As you ascend the valley of the Alpheus you are for some time in the rolling glebe-land of Elis; then when you get among the limestone mountains you climb up

and down—mostly up—dry and rocky paths, very fatiguing, the slopes on either side covered with prickly oak only, and many herds of goats feeding on them. This suggests the drier lands of eastern Greece. But Arcadia has to be crossed first—quite different country again, with high mountain ranges and great fir forests, and upland plains that more than any other part of Greece recall the upland plains of Switzerland. Greece is not very like Switzerland; its mountains, its valleys, its atmosphere have a different quality. But this part is least unlike, especially if from Demetsana, that fantastically situated town in western Arcadia, you take the high-road that goes across to Tripolis in the east. Just beyond Demetsana you come to a plain where the straight road, the river almost as straight running beside it, the fields, the fruit trees, and the grazing land on the lower slopes of the surrounding fir-covered mountains—the plain is so high that the vegetation has a northern character—call to mind the upper valley of the Rhone. Arcadia differs from the Pindus district in being altogether an upland country—these plains are 3000 feet and more above the sea—and you have not those remarkable deep gorges that so break up the mountainous country of Ætolia; and being already so high up, you do not get the same impression of steep grey mountains above you. The road I have mentioned, after going through all northern Arcadia, ascends through fir woods the slopes of Mount Messapius to the top of a pass, some 4000 feet up, then descends in many winding curves, traverses a pleasant rolling country, then climbs again a barer, severer range, and descends rapidly to the plain of Tripolis, and we are in eastern Greece: still 2000 feet up, and it is a long descent before the Argive plain is reached, but the boundary is crossed.

The Greeks have a story that when God was making this world He passed the earth through a sieve, and put down soil here for France, there for England, and so on everywhere; and at the end He had a great pile of stones left in His sieve, which He just threw over His shoulder and they became Greece. This would be especially eastern Greece, by which I mean roughly the whole eastern coast-line, the Argive peninsula, the Isthmus, Attica, the mountainous part of Bœotia and Phocis, including Delphi, Eubœa, and all the islands of the Ægean. I have left this to the last, to lay most stress on it. It is, in one sense, the most characteristic part of Greece. I do not mean that the rest is not characteristic; but it is so in a different sense of that rather vague word. I mean that there is a quality common to all Greece which makes it different from any other country, and of that quality eastern Greece has a larger share than any other part; whereas of those qualities which Greece has in common with other countries, other Mediterranean countries anyhow, the rest of Greece has a larger share than have Attica and Argolis. This special quality is easily recognized when one is in Greece, but is not easy to describe with accuracy.

It is due largely to the dryness of the atmosphere. As to the rainfall,

nowhere in Greece is it considerable compared with that of the north-west of Europe, but it rains much more in western than in eastern Greece, more than twice as much in fact. In Athens, the driest, as it is also the sunniest, place in Greece, the rainfall is only a little more than a third of what it is in Zante; only a fourth of that of Corfu. The dryness and consequent clarity of the atmosphere is therefore astonishing, because so much greater than that of ordinarily clear atmospheres, as in South France, Italy, or Macedonia. Then the mountains are in general not so high as in Arcadia and Ætolia; they range from 3000 to 5000 feet, as against 6000 to 8000. The greater number are bare of trees, growing only scrub and bush. Where there are trees they are mostly pines; and these with their light green colouring, their twisted trunks, and umbrella-like shapes contrast markedly with dark green and upright stems of fir trees. The plains are small in extent and slope down gradually and spread out to the seashore. The soil is light, too light for wheat, though barley is grown; light in colour too; for the most part you find vine-yards and olive groves; occasionally vegetable and tobacco fields. Other trees are the plane and the white poplar; oleanders grow profusely on river-banks or in the dry beds of streams. Hardly any rivers run continuously to the sea.

This greatly affects the colour of the country as seen from a height overlooking a plain. In spring you can see growing barley, the grey-green of the olive, the most delicate silver-green of the poplar, and the brown of plough-land. But the barley is harvested by the end of May, and after that the light brown of the soil is only varied by the never-failing olive and the dark green patches of vines or tobacco. Behind are hills purple with thyme, or the blue Ægean Sea.

You will have noticed that, except in a digression on the Gulf of Corinth, I have so far hardly mentioned the sea; and the omission may seem strange in speaking of country like Greece. Yet it is true that in western Greece, always with the exception of Ithaca and the coast-lands of Epirus, the sea is not the important feature of the landscape that it is in the east; just as the Greeks of the west, especially in western Peloponnese, have not taken to the sea as have the men of the east and the islands. For in eastern Greece it is not as a blue background with level horizon that the sea plays its most important part in determining the character of the scenery. It is where it meets the land—it is the actual line of the shore that is important, that is so fascinating to look at, so magical in its beauty. As I said, the plains here spread down to the sea; the plains of any extent, such as those of Argolis, Attica, and Chalcis, are few, but at the head of almost every bay of this so-much-indented coast there is a tiny plain. So that if you sail along the shore, close in, you have an ever-repeating and ever-varying alternation of irregular and rocky coast-line and the smooth curve of a strip of sandy shore. Fortunately photography can well represent this, especially photography in the hands of artists like Boissonnas

and Baud-Bovy, and their pictures will explain my point better than I can. These are mostly of the islands of the Ægean, each one of which has its own special character and individual beauty. But I would direct especial attention to one, namely Delos. This tiny island has not that advantage which is common to almost all the islands of the Ægean, a bold or harmonious outline when seen from the sea. It is not lofty, its highest point being but 500 feet above sea-level. It has no steep cliffs; and it has no specially attractive colour, for no tree grows there, nor anything green. It is a bare, rocky islet, quite dominated by its neighbours Rheneia and Myconos. But climb the hot and wearying path that leads to the top of that hill, and look down at the coast-line below, and you will be rewarded for your pains: the clearest possible line of sea and coast.

Such a view is to be had at almost any point near the sea in eastern Greece south of Volo (the coast of Thessaly is different), whether sailing by the shore or walking on land. Some headlands are high and steep—all are rocky—some bare, some covered with pine-trees to the water's edge; some, most delightful of all, are crowned with the ruins of ancient temples; some bays are wider and with flatter curve than others; while occasionally you pass a plain of exceptional richness, like that of Trœzen opposite Poros, which is covered with lemon and orange groves; but always this well-defined and sunny coast-line.

That, however, is for the nearer view. The distant landscape is bounded by the gracious and harmonious outline of the hills. Here you see most clearly the different quality of eastern Greece. In Ætolia or Arcadia the mountains are higher, nearer, more immediately above you, and dark and rich in colour, where fir trees clothe their slopes. If the trees cover all the mountain up to the summit, the outline is confused and the inner markings, the modelling of ridge and valley, are lost. I don't mean, of course, that the Arcadian mountains have the soft and rounded contours of northern hills; but they are not so clearly defined and, above all, not so light as those of Attica or Argolis or the islands. The outline and the light are the essentials, the points to be emphasized. The colours are the most delicate possible; green, the light grey of limestone, the blue of distant hills—not the blue of distant trees and hedges that you get in England—the purple shadows in the early morning and the orange and rose that suffuse all the hills in the evening; all are light and cool colours; not pale or washed out—the very opposite—nor confused one with another, but each clear in itself, and bathed in light; luminous colours. The best word I can think of to describe the general effect in Greece is translucence. It would be an exaggeration, but only an exaggeration, not a distortion of the truth, to say that the effect is like that of light shining through thin marble or alabaster. In other countries, of more generous soil, the colour of the sky may be luminous, but the colours of the earth are of a different quality, richer and more opaque;

in Greece the quality of the colours of the earth is the same as that of the sky, equally luminous and cool. You will see now why I think that "brilliance" is not the right word to describe Greece; at least it suggests to me rather a variety of rich and hot colours, or a sparkling hardness, not the delicacy of Greek colour and outline. It may surprise you as much as it did and does me; but the country which seems to me likest Greece in the delicate colouring and luminous atmosphere of a distant view, is the country of the Campsie and Kilpatrick hills near Glasgow, on a rare fine day in winter. It is remarkable how clear the air can become on a sudden in that rain-soaked land.

You know the story—very typical of Greek artists—of the two painters Apelles and Protogenes. Apelles went to call on Protogenes, but found him out; and when the servant asked who should she say had called, he took a brush and drew a fine line on a canvas, saying that Protogenes would know who it was. The latter came in afterwards, recognized the master's hand, took another brush and in another colour drew a finer line over that of Apelles, and told his servant to show it him when he called again. Apelles did call again, and drew a third and yet finer line on the other two; and Protogenes then confessed himself beaten. Well, that gives one an idea of the lines of Greek scenery, whether the inner markings that divide light and shade or the outline of hills against the sky; they are quite definite, but as far from heaviness as from confusion. It seems to me that one is helped to a perception of this by a sentence in Mr. Bertrand Russell's 'Introduction to Mathematical Philosophy,' in a passage where he has been defining mathematical continuity. I hope I am not quoting words which I don't understand—a thing one is always afraid of in quoting from a mathematician; but at least it requires no apology to take a simile from mathematics when speaking of Greece. "The general idea," he says, "vaguely indicated by the word 'continuity' when employed by many philosophers (which is a kind of fog), is one which is certainly quite different from that which we have been defining. Take, for example, the series of real numbers. Each is what it is, quite definitely and uncompromisingly; it does not pass over by imperceptible degrees into another; it is a hard, separate unit, and its distance from every other unit is finite, though it can be made less than any given finite amount assigned in advance." So it is in a Greek landscape; there are no foggy outlines, and one colour does not pass over imperceptibly into another; the difference between two neighbouring colours may be almost infinitely small; but the lines remain quite definite. You can use of Greek scenery the phrase often used by the ancient critics of Greek art, "the accuracy of its beauty."

Argolis has this distinctively Greek characteristic of delicacy and definiteness of colour and outline more purely perhaps than any other part of Greece; just as the ancient Argive school of sculpture possessed that quality which is so distinctively European when compared with Asiatic

art, and yet is so particularly Greek that it has never reappeared in Europe in so pure a form. Attic art had a wider range and more variety than Argive; so is Attica more varied than the Argolid. There are walks there in shady glens, where the orchid and narcissus grow among the streams of the Cephissus river, of which Sophocles sang; Attica has almost all that Argolis has, and more besides. But Argolis is, as it were, the test. If you are content there, say on the citadel of Mycenæ looking over the plain towards Argos and Nauplia and westwards to the mountains that border Arcadia, then you have penetrated, at least I think so, into the austere spirit of Greek landscape.

I wish my words were anything like so clear and definite as the country I have been trying to describe. I have, of course, left out much —not detail only, but I have said nothing of the mountain country of Olympus and Ossa and Pelion, very different from the rest of Greece, nor of the rich plains of Messenia and Sparta, nor of Mitylene or Chios; nothing, above all, of Crete, which has a variety ranging from the bare mountains of the east to wooded slopes and copses where foxgloves reach above the bracken amid the roots of oaks and beeches. But time, and I am afraid your patience, forbid. But I hope what I have said means something, and describes in some measure that quality in Greece which makes you feel you are in a different land when you cross over into it, not only from Italy and the west, but even from its immediate neighbours on the north, Macedonia and Thrace, Serbia and Bulgaria, all of which despite their nearness to or contact with the Ægean belong in the character of their scenery to Central Europe and not to Greece.

Before the paper the PRESIDENT said: The lecture this evening on the Scenery of Greece by Mr. Gomme, who has been for many years out in Greece, is in the nature of a new departure. We in this Society are accustomed to take a perhaps rather limited view of Geography, but in this lecture we hope to hear of the beauty of Greece, and not merely of its physical measurements. We consider that a description of the beauty of the country is just as important as its accurate physical measurement. Geography is the description of the Earth, and the part of the Earth which Mr. Gomme will describe this evening is Greece, and he will describe, not the height of the mountains, the length of the rivers, and the contour of the coast-line, but the beauty of its scenery. Personally I look forward to the time when Mr. Reeves will have a colleague in our Society. Mr. Reeves, very efficiently and with very great success, teaches intending travellers the way to map a country and the way to take accurate measurements of the mountains, rivers, and so on, but I hope the time will come when he will have a colleague who will teach intending travellers the way to observe, and the way to describe the beauty of a country. This lecture is, as I say, the first step in that direction. We have a traveller who is more especially concerned with observing and with describing to us the natural beauty of a country he knows. Mr. Gomme was a student in the British School at Athens, and has for many years past spent a few months travelling in Greece. He is thus very intimately acquainted with it. I ask Mr. Gomme to give us his lecture.

Mr. Gomme then read the paper printed above, and a discussion followed.

The PRESIDENT: Will Prof. Myres, whose knowledge of Greece is so very great, and who gave us such an excellent paper on the Dodecanese last year, kindly open the discussion?

Prof. J. L. MYRES: It is a very great pleasure to have the opportunity of expressing my appreciation of the paper to which we have just listened. I know Mr. Gomme knows about Greece, for we only just escaped being colleagues years ago in the Classical Department in Liverpool University. I know he has been in Greece, because we had the happiness of working together there during the last few years. He has illustrated in very happy fashion the kind of synthesis and interpretation which you, sir, called for so suggestively in your Presidential Address last year. We call the rainbow, for example, a beautiful thing, and appreciate its beauty all the while that with the spectroscope and other means of accurate determination, we translate the physical fact which we feel to be beautiful, into accurate measurements and statistics. And in the same way we are beginning, I imagine, to learn the alphabet and some of the grammar of the language in which scenery in any country speaks to us. Like people who will go and see a Greek play and feel (though not understanding a word) that this is a big thing, and that the bigness of it centres in the language, so we too are impressed when we come face to face with great pieces of Nature's eloquence. They have style, they have meaning, like the spoken word; they leave us a little different from what we were. Using, too, another word "picturesque," which like "style" has gone downhill, when we distinguish between one style of scenery and another, and say that this or that is "picturesque," I suppose that what we mean is that others have been before us in appreciating scenery of that kind, and have made their schoolboy translations of the great original. It is thus that without any disrespect I would characterize those extremely interesting sketches which Mr. Gomme has presented to us, along with his photographs. I would pay them the compliment of regarding them as an exceedingly interesting attempt to translate into a rather simpler language some of the eloquence of the scenery of Greece. Some of them—and especially the sketch of that view from Delphi—have shown me things which I did not quite understand from study of the place and photographs. I must look at the photographs again and see if that translation is right.

Why is it that one feels (and all the more as one comes to know the country better) that Greece is, in some special sense, a beautiful country? I think it is partly this, that as some of the greatest literary style is the simplest language best used, so the message of Greece, the signals that it gets through to the ordinary human being who is trying to be a wild man once more, are signals of the simpler and more emphatic kind; partly, I suppose, because of that extraordinary clarity of the atmosphere. There is no doubt of the shape of a hill in Greece. It is not merely the almost total absence of obscuring vegetation. You do really see what is there, sometimes in a disconcerting way. You feel you can count the stones on the hillside—and with a glass you could count them! And yet even in this clear air there is frequent refraction and most elusive mirage. Walk daily over the slope of Lykabettos, as I have for many months together, and see the same Acropolis coming out over the spur; never to the end of my time was I able to discover exactly where the horizon really cuts the profile of the Acropolis. So infinitely various is this apparent precision of statement. And the simplicity of the message of Greece comes partly from the circumstance which most differentiates this Nearer East

from our West, also that, in spite of its very small rainfall, it has, in the long past, suffered far more ruthless denudation. That comes out in the first great descriptive analysis of Greek scenery (as distinguished from mere description) in Plato's dialogue *Critias*, where the question is raised, How is it that the Greece we know is so different from the pre-historic Greece which Socrates has been trying to reconstruct for his young hearers? And the answer is that "there have been great floods of rain since. What you see now is like a dead animal with the bones sticking through the skin." Then the intelligent young man asks, "Where is all that earth gone, and why have not we great mud flats inshore?" and the reply is, "You know how deep the sea is round here: it is not filled up *yet*." It is that kind of simplicity of statement as to what is, and has been, going on in Nature, that I think makes Greek scenery so ideal an introduction to that kind of natural "eloquence," to the message which one's own experience brings, as one watches any kind of scenery; and which makes one so especially grateful to Mr. Gomme for the way in which he has brought home to us some of its salient characteristics.

Sir MAURICE DE BUNSEN: I am not qualified really to speak about Greece, but I am glad to add my thanks to those which have already been expressed to Mr. Gomme for his lecture, which to me has been extremely interesting and instructive. I think he has kept very strictly indeed to his subject of the natural beauties of Greece. By taking the photograph so as to include an old standing column or a corner of the Acropolis he might have attached to the picture some quotation from the Classics which he knows so well, and have told us the history of the particular scene shown to our eyes; but even in what he showed us he kept to his subject—the beauty of the scenery, and the different characteristics of the scenery in different parts of the country. It has been very instructive, and I think it will no doubt lead many to read up our Greece. Having for many years entirely neglected the Classics, I have in recent years taken to reading them again, and the lecture I have heard this evening will make me pursue my reading into the realms of Greek classic literature, as I have already begun with Latin. It is now so easy for everybody who has the slightest knowledge of those languages to read them in the Loeb edition, which really is nothing more than the beautiful original on the one side and a very good crib on the other. I have derived great pleasure and instruction from the lecture, and wish again to thank Mr. Gomme for what he has said to us.

The PRESIDENT: It is perhaps time that I should sum up the discussion. Mr. Gomme quarrelled with the use of the word "brilliance" in describing Greece in my Presidential Address last year, and perhaps I should make a confession in that regard. I was not, at the time, thinking how I should sum up the beauty of Greece in one single word, but as a matter of fact I had that one single word "brilliance" in my mind, and I was looking about among the different countries in the world I had visited for one to which I could apply it, and I applied it to Greece, because on the last occasion upon which I went through Greece, leaving here in the month of December, travelling across the Continent at the dullest time of the year, coming down from Constantinople also thick in cloud, and emerging into the Ægean Sea, with the beautiful islands of Greece glittering in sunshine and set in seas of dazzling blue, brilliance was the exact impression which lay upon my mind. So I hope the lecturer will kindly excuse me for applying the word to Greece. But at the same time I agree that there is much to say for the word which he would wish to substitute for brilliance, namely, translucency. I had not

particularly noticed this translucency in Greece, but I have observed it in other countries, and it is specially noticeable in comparison with the atmosphere of this country. In countries where the air is extremely clear, as it is in Greece, and where the colours are very definite and the outline of the country very definite too, one does get that quality for which the exact word is translucency. Natural features appear to be not opaque but translucent. Another interesting point which Mr. Gomme brought out and which it is well to remark and remember, is about the purpleness of the shadows. If you take a flower and hold it up to the shadow, you see there is not much difference between the purple of the thyme and the purple of the shadow. When I saw those pictures on the screen of the monasteries back away in inaccessible points on the cliffs it reminded me of Tibet. The photographs might have been taken as well in Tibet as in Greece. In both countries these monasteries of solid masonry are built up against cliffs in very inaccessible points, and there the monks lead their secluded lives. I suppose they were originally built there as being safe from attack in troublous times or as being well secluded from mankind. But the monasteries in Greece are not of the size of the monasteries in Tibet—some of the monasteries near Lhasa being almost towns, and the monks numbering 5000, 6000, and even 8000. Mention has been made of Socrates and his conversation with his pupils as to why the mountain-sides have changed. There is one cause of the change which possibly was not recognized by Socrates and was not mentioned by the speaker, and that is the goat. Whenever the goat gets about in a forest he eats up the sprouting trees, and in the course of time the forest disappears. It is quite probable that in very early times the islands were covered with forest, but that when human beings came in bringing with them goats, the result was that the forests disappeared. In Kashmir, where there are now considerable forests, one of our main efforts is to keep the goat at a distance. Thousands of goats come up from the plains of India to Kashmir in the summer to feed on the pasture, and our great difficulty is to keep them out of the forests. So perhaps the changes in the scenery of Greece may in some part be due to the depredations of the goat. Prof. Myres has added great illumination to the lecture, and he has helped us to understand still further the beauty of Greece. He spoke about the impression which Greece made upon us, and perhaps not unintentionally he likened us to wax! But we are not like wax. We do not all receive the same impression, and we *respond* to the impressions instead of receiving them impassively like wax. The impression which is made upon one individual is quite different from the impression made upon another. Each receives a different impression, and each makes a different response to that impression. Reference has been made to the altering conditions of the scenery in Greece—even of the Acropolis. On no two days is it the same, and we may also say that on no two days does any single individual look upon it in the same way. So, in observing and describing the natural beauty of the country, an inexhaustible field is opened up. Not only is the natural beauty continually changing, but the men who observe it are themselves changing from day to day. I am sure you will like me to thank Mr. Gomme for the way in which he has described to us wherein the beauty of Greece lies, and how we are to observe and describe it.

THE WORLD MAP BEFORE AND AFTER MAGELLAN'S VOYAGE

Edward Heawood, Librarian, R.G.S.

Read at the Afternoon Meeting of the Society, 11 April 1921.

FOUR hundred years ago, in April 1521, died Fernão de Magalhães, more familiarly known to Englishmen as Ferdinand Magellan, perhaps the greatest of the world's great navigators, the first to venture across the vast extent of the Pacific Ocean, and by so doing to virtually, if not actually, achieve the first circumnavigation of the globe. The man himself was worthy of the achievement, which was but the due reward of indomitable courage and determination, coupled with the highest seamanship and other fine qualities not always found united in the successful man of action.

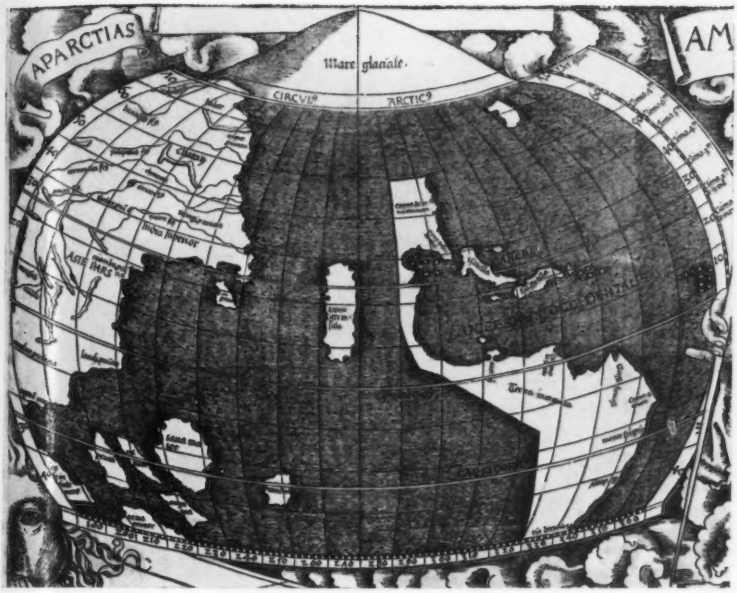
In this paper no attempt will be made to deal in a general way with Magellan's life and voyages. This has been admirably done by Dr. Guillemard in his well-known Life of the navigator, while the original narrative of the great voyage by Antonio Pigafetta has been made accessible in the English versions of Lord Stanley and Prof. Robertson; and a considerable foreign literature on the voyage is also in existence. The aim of the present paper, rather hurriedly put together as in some sort a commemoration of the quatercentenary on April 27, is a more modest one, concerned chiefly with one special aspect of the voyage—its relation to the geographical conceptions of the age in which it was made. By a survey of the most important cartographic documents before and after the voyage, an attempt will be made to bring out, first the influence on Magellan exercised by the ideas of his time, and next the influence of the voyage itself on the cartography of the time immediately following.

In any question relating to a possible circumnavigation of the globe, the views and theories of the early Greek philosophers still exercised great influence in the Age of Great Discoveries. The sphericity of the Earth had been fully accepted by the best Greek thinkers from Aristotle onwards, and it was held to be quite a possibility to reach India by sailing west from the Pillars of Hercules. This teaching had been greatly obscured during the dark ages, when the crude idea of a habitable world surrounded by the ocean, such as is illustrated by the map of Marino Sanuto (1321) and by many others, held sway over the minds of churchmen and the general public. Still it had never been quite lost sight of. The size of the Earth had been calculated by Eratosthenes (about 220 B.C.) at 250,000 stadia, which on the basis of 10 to the geographical mile, gave an equatorial circumference only about one-sixth more than the true measure. The habitable portion, from Spain to the end of India, was reckoned by him as 77,800 stadia on the parallel of Athens, on which the circumference was reckoned as about 200,000 stadia; so that the proportion of land to sea

(or at least of the known to the unknown) would be about as 1 : $1\frac{1}{3}$. This estimate was in excess of the true length of the Old World by about one-third. It may be noted here that the estimate of the distance to be covered by sailing over the unknown portion might be vitiated in two ways—first by mistakes in the calculation of the size of the Earth, secondly by mistakes in estimating the proportion between the known and the unknown. Now the exaggerated estimates of Eratosthenes were abandoned by his successors, who fell into the opposite error. Posidonius (first cent. B.C.), followed by Marinus of Tyre (second cent. A.D.) and his copyist Ptolemy, reduced the circumference to 180,000 stadia, giving only 500 to the degree instead of the 700 of Eratosthenes. But while thus reducing the whole circumference (in fact as a direct result of such reduction) Ptolemy overestimated the extent of the land area in degrees of longitude (his degree representing only five-sixths of its true measurement), and the error was enhanced by the overestimation of distances, even in stadia, by sailors and travellers. The longitudinal extension of Ptolemy's land area was thus fully 180° or half the circumference, from the Canaries to China, while it extended indefinitely beyond, since no termination was hinted at within the limits of the map. This representation of Ptolemy was of the greatest influence on the cartography of the time before Magellan.

On the revival by Columbus of the idea of the ancients that the east could be reached by sailing west (for it can hardly be doubted, *pace* M. Vignaud, that India was the goal kept in view from the first by the Genoese), these inaccurate ideas of the comparative smallness of the unknown ocean were even exaggerated by the acceptance of an Arab estimate of the size of the Earth, which seems to have reduced the length of the degree, as compared with Ptolemy's estimate, from $62\frac{1}{2}$ to $56\frac{2}{3}$ Italian miles. This gave a circumference only three-fourths of the reality.

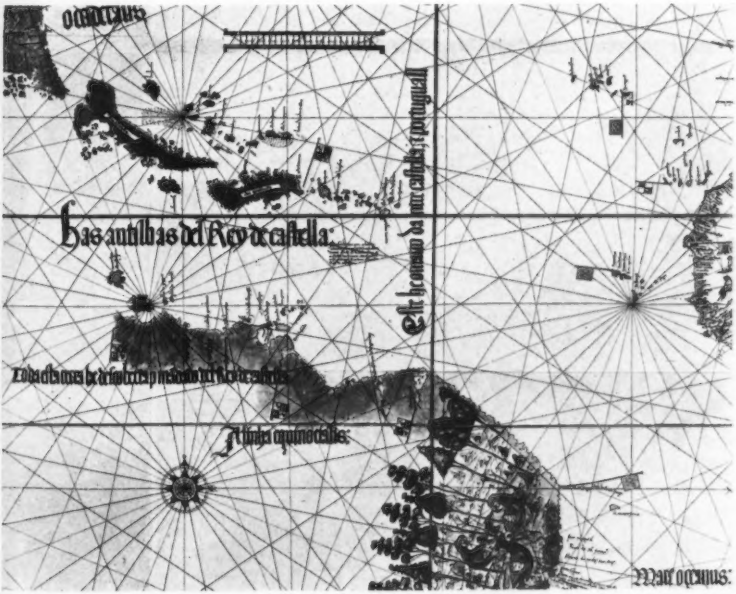
Next, as to the political conditions between Spain and Portugal, which affected Magellan's great enterprise. The venturesome voyages of the Portuguese under Prince Henry's inspiration had made known the whole coasts of West and South Africa down to and beyond the Cape of Good Hope, as well as the Atlantic groups of the Azores and Cape Verdes, before the voyages of Columbus, and the political rights of Portugal had been confirmed by Papal Bulls, which gave to that nation by anticipation all the lands that might be discovered "usque ad Indos." When therefore Columbus returned early in 1493 with news of discoveries beyond the Atlantic, the Spanish sovereigns lost no time in applying for similar rights from Pope Alexander VI. Much misconception has prevailed as to the precise scope and character of the successive Bulls promulgated with this object during 1493, but the true position has quite lately been admirably demonstrated by a Belgian writer, Prof. H. Vander Linden. So far from representing the award of an arbiter between opposing claims, the Bulls were merely grants made at the instance of, and in terms suggested by,



1. THE WESTERN HEMISPHERE, FROM THE INSET IN WALDSEEMÜLLER'S GREAT MAP OF 1507, SHOWING THE PACIFIC GREATLY REDUCED

(*From the facsimile by Fischer and Von Wieser.*)

The left half follows Behaim (see No. 4).



2. PORTION OF THE CANTINO MAP, 1501-2, SHOWING THE LINE OF PARTITION BETWEEN THE SPANISH AND PORTUGUESE SPHERES

(*From the facsimile accompanying Harrisse's 'Les Cortereal,'* 1883.)

3. THE CANERIO MAP, 1502, FROM DR. E. L. STEVENSON'S REPRODUCTION (MUCH REDUCED)

The ten sheets of the original combined into one.

one party only—Spain—by a pope who was, for private and political reasons, entirely subservient to the Spanish sovereigns. The binding nature of the grants was never recognized by the other party—Portugal—and it was by independent negotiations, in which the pope took no part at all, that the final arrangement was reached by the treaty of Tordesillas, signed the next year, 1494.

In one only of the four Bulls of 1493 (the second in order of promulgation) was any definite line of demarcation laid down, and this, which seems to have been suggested by Columbus himself, was rather of the nature of a boundary to a Spanish preserve—not to be overstepped by any person not authorized by the Spanish sovereigns—than a line of partition. Its terms were ambiguous (though not perhaps much more so than those of many modern treaties of delimitation), the line being described as running from pole to pole 100 leagues (the league was then four Italian miles) west *and south* of any island of the Azores and Cape Verde islands. It is impossible to attach any definite meaning to a *meridional* line running west and south of a given point, but the intention is fairly obvious. Columbus was then already planning a second voyage, hoping to extend his explorations southward. On the other hand, Portugal had put forward an excessive claim to everything south of Cape Bojador, which it was important to frustrate. The expression "towards the west and south" occurs three times in the same paragraph of the Bull. In two cases its use is quite justified as it is a case of *discoveries* to the west and south, but it seems to have escaped the draughtsman, in his desire to insist on the point, that in the third case the phrase was not strictly applicable. The starting point also has been variously interpreted, but the intention evidently was to give a clear interval of 100 leagues beyond the furthest outlier of either group.

Thus, although the partition of the world between the two Powers has been popularly ascribed to the pope, the idea is not strictly correct. Neither did the pope effect such a division in 1493, nor did the line then laid down really take effect at all, for the only arrangement accepted by both sides was that of the treaty of Tordesillas, signed 7 June 1494 after friendly negotiations. In this, to meet the views of Portugal, the line was drawn, not 100 leagues west of any island of either group, but 370 leagues west of the Cape Verdes, with no indication which island it was to pass through. The intention probably was once more to give a clear interval of 370 leagues west of the whole group, but the ambiguity naturally encouraged conflicting interpretations later. Even now attention seems to have been wholly directed to the Atlantic side of the globe, and nothing definite is said about the application of such a line to the Antipodes. At first the way seems to have been considered open to either Power to acquire rights in the Indies by virtue of discovery and occupation, and it was only later that the Atlantic line was tacitly taken as to be prolonged through the poles to the opposite side of the world.

In order to understand the conditions which impelled Magellan to his great undertaking it is necessary to glance at the course of events between 1494 and 1517. The later voyages of Columbus and other Spanish captains to the western lands had revealed the fact that here was a new world stretching from north to south and blocking any direct maritime route to the East Indies by the west. Meanwhile the Portuguese under Vasco da Gama had already gained the great object of their ambition and under Almeida and his successor Alboquerque had firmly established themselves on the west coast of India, had taken Malacca, the great emporium of trade on the west coast of the Malay peninsula, and under Abreu had pushed on among the rich and renowned islands of the Archipelago. An important though not a pre-eminent part had been taken by Magellan in these great doings. A Portuguese by birth, attached in his young days to the court of the king, he had early opportunities of mixing with the sea-captains and other adventurers, and in 1505, at the age of about twenty-four, had sailed to the east in the fleet of the viceroy, Almeida. During seven strenuous years he had borne his share in battles and hardships, but though many times wounded had suffered no serious disablement. He formed a close friendship with one Francisco Serrão, who commanded one of the ships in Abreu's voyage to the Archipelago, and, being wrecked on the return voyage, made his way to the famed Moluccas or Spice islands, where he remained for the rest of his life. His letters sent hence to his friend Magellan told of the wealth of those parts, and no doubt were the means of turning the serious attention of the latter to the Spice islands as a field for enterprise. Returning to Portugal Magellan afterwards served in Morocco, was once more wounded so as to become slightly lame for life, and, after friction with his superior officer, had the misfortune to incur the displeasure of the king. Unable on this account to obtain any chance of distinction by further service with his countrymen, he took the step, no unusual one in those days, of offering his services to the King of Spain (the Emperor Charles V.), having already for some time nourished the idea that the true road to the Spice islands would be by the western or Spanish route. Getting his scheme adopted in the end, he set sail on 20 September 1519, and, after passing safely through untold dangers and hardships in the passage through his strait and the trackless Pacific Ocean, met his death in the Philippines, in a fight due to a tragic error of judgment, on 27 April 1521, leaving to his subordinate Delcano the task of bringing one of the ships, the *Victoria*, safely home to Portugal by the Cape of Good Hope.

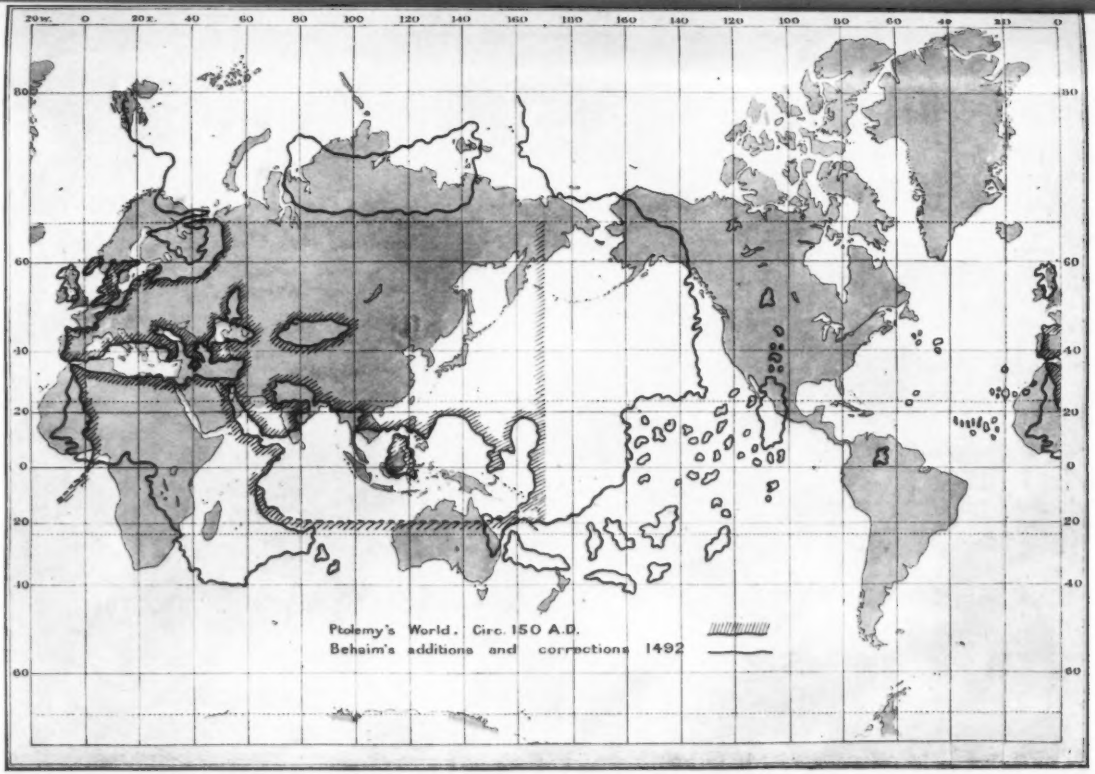
We may now consider the current ideas of World-Geography in the years before Magellan's voyage in the light of the cartography of the time. The documents that have come down to us are unfortunately but a tithe of those almost certainly once existing, those we know having in many cases been saved only through a happy chance. For the years following the first voyage of Columbus, though Spanish maps must certainly have

been made (and we have one most important one in that of Juan de la Cosa), some of the most striking maps known to us are of Portuguese origin. Before examining these we may glance at the maps current at the time of Columbus' great adventure and representing the notions accepted by him at his first setting out. They may be illustrated by a reconstruction of the so-called Toscanelli map, once thought to have supplied the main incentive to Columbus, but now considered to have had no connection with the Florentine astronomer, nor even to have been in existence at the date of the first voyage. It shows the whole space intervening between Portugal and the coast of China—in reality filled by the two great oceans and the whole breadth of North America—as occupying twenty-six spaces of 5° each—130° in all, in place of the actual 230°. Precisely the same scheme is to be found in Behaim's famous globe of 1492, of which Dr. Ravenstein's fine reproduction is exhibited in the Museum. In fact, the western part of the Toscanelli map has been reconstructed from Behaim. Behaim's representation of Eastern Asia is practically identical with that of Henricus Martellus, in the map of about 1489 preserved in the British Museum. Its most striking feature, reproduced in a host of later maps for over half a century, is the huge excrescence to the east of the Malay Peninsula, sometimes spoken of as a duplication of the latter, but really derived directly from Ptolemy, who, it will be remembered, drew a land-connection between eastern Asia and Africa, making the Indian Ocean a closed basin. It was now known that this was a mistake, but such was the reverence for Ptolemy's authority that his *Sinus Magnus* was retained and with it the further coast-line to the east, which Ptolemy had turned as it were on a pivot so as to run south and south-west instead of north and north-east. The eastern coast of this vast peninsula was now filled in by pure conjecture on the basis of Marco Polo, with the result that Asia—the longitudinal extent of which even up to the *Sinus Magnus* had been greatly exaggerated by Ptolemy—was still further extended eastward, leaving between it and western Europe the greatly diminished space already spoken of. That this representation marked a retrograde step is shown by the anonymous Genoese map of forty years earlier (1447), which, in spite of its generally crude construction, shows a far better apprehension of the geography of South-East Asia than many much later maps. A fine reproduction of this map is in the Society's collection. How the excessive extension of the old world held its ground even after the discovery of America is shown by the great map of Waldseemüller of 1507, and particularly by the inset map of the western hemisphere (Map No. 1). With America now intervening between Europe and eastern Asia, the space left for the unknown Pacific is reduced to a minimum—only 70° between the isthmus of Panama and the coast of China. In Ruysch's map of 1508 Asia is actually extended north-east to join the discoveries of Cabot and Cortereal in the North Atlantic.

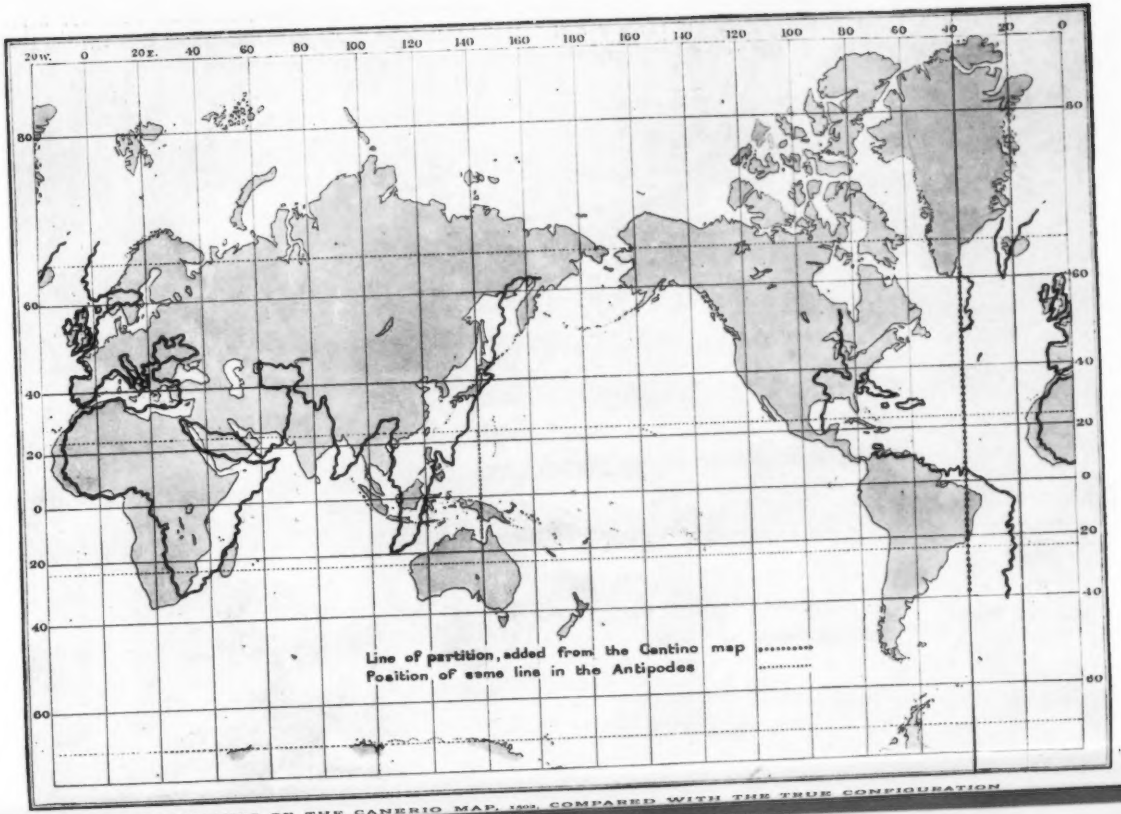
Of the improved Portuguese type of map that of Nicolo de Canerio,

a Genoese working from Portuguese originals, may be taken as representative (Map No. 3). Its probable date was 1502, but its sources were no doubt rather earlier. The great progress indicated by this map is at once apparent. The new maritime discoveries in Africa, Asia, and America all find a place, and for the first time the Indian peninsula appears in something like its true proportions. One of the most striking innovations is the departure from Ptolemy's exaggerated estimate of the longitudinal extension of the Old World. As in other marine charts, there is no scale of longitude, but one of latitude is provided, and we may suppose the same scale applicable to the longitude on the Equator; in any case it was so understood by Waldseemüller, who inserted the longitude scale in this sense in his *Carta Marina* of 1516, itself in the main copied from Canerio. On this basis we find the length of the Mediterranean reduced from Ptolemy's 60° to only 35°, or actually some 5° less than the reality. This reform (not generally accepted till many years later) was offset to some extent by an exaggeration of the longitude covered by eastern Africa and Arabia, involving a serious displacement of the axis of the Red Sea. On the other hand, the extent of the rest of southern Asia is so curtailed as to occupy only 46° in place of Ptolemy's 77°, again actually 5° less than the reality. The total reduction from the Strait of Gibraltar to the Malay Peninsula amounts to fully 40°—from 155° to about 114°, the correct figure being about 109°. Canerio's is the first serious attempt to represent the Malay Peninsula as it really is, with Malacca correctly placed on its west coast, though he exaggerates its size and southward extension. The map ends to the east at a line through China, and there is no trace of the south-eastern monstrosity which deformed so many maps. (Yet we find Waldseemüller in 1516, even when copying Canerio, still marking Ptolemy's *Sinus Magnus* to the east, and an almost contemporary map also attributed to him still shows the huge peninsula, so long were the makers of maps obsessed by a once-accepted tradition.) By thus curtailing the length of the Old World, and discarding the imaginary prolongation of Asia as well as the great islands strewn by other map-makers in the ocean to the east, the Canerio type of map greatly extended the space left to be covered by the Pacific Ocean, the great size of which must by this time have begun to dawn upon the minds of both sailors and geographers. It was even unduly extended on the American side in the Canerio map by the eastward shifting of the east coast of Brazil, as compared not only with the reality, but with the representation on other maps of the time. The unknown portion, from the east coast of Brazil to the Malay Peninsula, is thus made 25° more than the reality—225° instead of 200°. The accompanying outline-maps show the conceptions of (1) Behaim and his copyists; (2) Canerio, in relation to the actual facts (Maps 4 and 5).

We have next to consider the line of demarcation by the treaty of Tordesillas, as drawn by the cartographers of the period. It is most



4. THE WORLD ACCORDING TO PTOLEMY, WITH BEHAIM'S ADDITIONS AND CORRECTIONS, COMPARED WITH THE TRUE CONFIGURATION



5 OUTLINES OF THE CANERIO MAP, 1502, COMPARED WITH THE TRUE CONFIGURATION

explicitly shown in another map of the Canerio type—that known by the name of Cantino, the representative in Portugal of Hercules d'Este, Duke of Ferrara, for whom Cantino had it drawn. This map, a fine reproduction of part of which, brought out by Harrisse in 1883, is in the Society's Library, shows the line (labelled "Este he o marco da ntre Castella e Portugall") as cutting South America just east of the more easterly of the two great estuaries on the north coast, perhaps intended for the Gulf of Maranhão. It is difficult to reconcile this position with the 370° leagues west of the Cape Verde islands, as indicated by the scale of miles, suitably corrected for the latitude of the group, the line being not far enough from *any* island of the same. However this may be, the line no doubt represents the position of the boundary as accepted in Portugal at the time, and it is very similarly shown in a later Portuguese map, belonging to the School of the Reinels, of which a coloured reproduction was published by Kunstmann in 1859. If we transfer it to the Canerio chart it falls, according to the longitude numeration supplied by Waldseemüller, in 334° east (or 26° west) of the Canaries, and its continuation on the opposite side of the globe would fall in 154° E., or about 30° east of the central line of the Malay Peninsula. We may see here, perhaps, an indication of political motive, both in the curtailment of the length of the Old World and in the eastward shifting of South America, the result being to bring a larger share of the new discoveries within the Portuguese hemisphere. In the more usual type of map, which long continued to hold its own, in academic circles at least, the line through the Antipodes would run well to the west of the Malay Peninsula, leaving both this and all the archipelago to Spain. Even in the Canerio type of map the Spice islands—the great object of attraction in the far east—would fall only a little west of the boundary-line, and Magellan, who claimed them as within the Spanish hemisphere, seems to have found some support for his claim in other Portuguese maps, even of the nautical class. The most important of these after 1502 (of those now known to us) were made by the Reinels, father and son, and their school. Opinions differ somewhat as to their importance, one writer—Denucé—placing them quite in the forefront of the maps of the time, while the verdict of others is less favourable. In any case they are the earliest known maps to show the results of the first Portuguese voyage to the Archipelago—that of Antonio d'Abreu in 1511, in which Magellan is said to have taken part, and we are expressly told by Argensola that it was by a map of Reinel's that Magellan explained his scheme of a voyage to the Spice islands by the west to the Emperor Charles V. The Reinels were summoned to Spain in connection with the voyage, and seem to have at least directed the construction of the charts taken on board the ships. It is somewhat strange that whilst Canerio had discarded the *Sinus Magnus* and eastern peninsula of Behaim and others, Reinel still retains them in his Atlas of the Indian Ocean (about 1516), from the sheets of

5. OUTLINES OF THE CANERIO MAP, 1502, COMPARED WITH THE TRUE CONFIGURATION

which a combined chart has been drawn in outline by Denucé. For the parts of the east actually visited by the Portuguese there is a distinct improvement on Canerio, *e.g.* in the representation of both Indian peninsulas—the more easterly (the Malay) now correctly cut off north of the Equator—in the shape and position of Sumatra, and in the insertion of Java and the train of islands to the east visited by Abreu. The longitude of southern Asia is still more correctly given than by Canerio, if we may suppose the latitude scale to apply also to the longitude on the Equator. The intervals between C. Guardafui and the Malay Peninsula (53°) and between the latter and the Moluccas (24°) are both correct within a degree or so, such accuracy lending support to the idea that longitudes had here been fixed by observations of lunar eclipses. Unfortunately, as no longitude numeration is given, it is impossible to say just where the line of demarcation would have been drawn by Reinel, all depending upon the longitude of C. Guardafui accepted by him. Another map, made by the Reinels a year or so later, shows further improvement, especially in the greater width given to India, the better shape of Arabia, and the nearer approach to a correct representation of the Archipelago. Map No. 6 reproduces a part of this.

The formidable nature of the task involved by a circumnavigation of the globe must by this time have become fairly apparent, though not yet perhaps quite fully realized. Whilst Columbus was constantly imagining the countries reached by him to be those of eastern Asia, it soon came to be recognized, with the progress of exploration in Central and South America, that an independent land mass—the Mundus Novus of Vespucci—blocked any direct sea-route to the East Indies by way of the west, though many maps continued to indicate a strait in the locality of the Panama isthmus. Quite early in the sixteenth century the coast of South America had been traced beyond the La Plata estuary, and no passage had been found, though the globes of Schöner of 1515 and 1520, with the geographical treatises issued simultaneously, have led some to believe that at least the entrance to Magellan's strait had been discovered before his time. The development of the cartography of South America between the voyages of Columbus and Magellan is well brought out by a series of small outline maps, given by Dr. Ravenstein in his work on Martin Behaim. They show the gradual extension of the coast southward so as to form more and more of a barrier to one wishing to reach the east by the west, and also the great exaggeration by the map-makers of the longitudinal extension of the continent, which reaches a maximum in the version of Bartholomew Columbus, who actually joins South America to the east of Asia. This supposed extension westward would give encouragement to a navigator proposing to cross the Pacific, as affording a coast-line which might be followed for a considerable distance across the unknown area. Thus in the rough sketch-map attributed to Leonardo da Vinci only quite a small distance intervenes

between South America and Asia. An improvement on any of these maps is again shown by one made by the Reinels about 1516, which clearly marks the entrance to the Rio de la Plata, and is an excellent specimen of the artistic work of its authors (see Map No. 7).

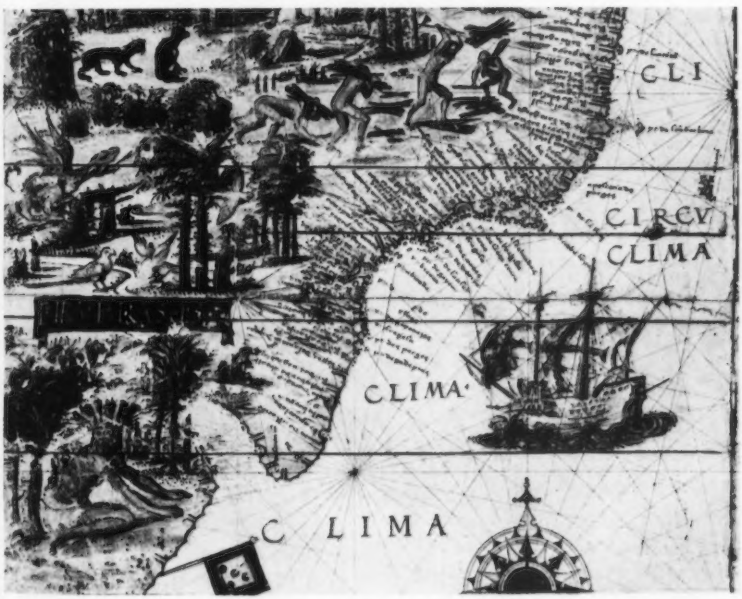
The globe-map of Schöner, already spoken of, supplies one of the chief arguments for the belief that the existence at least of Magellan's Strait had become known before the great voyage. The idea of such a strait is of course bound up with the belief in a southern land, which finds expression in various maps of the period. Such a land is shown, for example, in Leonardo da Vinci's map, though here it is placed much farther south than by Schöner. But the notion of an Antipodean continent, balancing, so to say, the known world of the northern hemisphere, dates back to a high antiquity, and recurs many times during the Middle Ages. It is to be found, *inter alia*, in the scheme of Pomponius Mela (first century A.D.). Some maps place a mythical southern land in the south of the Indian Ocean (possibly as an inheritance from Ptolemy). Such ideas had perhaps been fostered by imperfect knowledge of actual voyages to South America, and by the loose way in which the name Brazil (derived from the Brazil wood or verzino, known as a tropical product before the discovery of the modern Brazil) was applied to lands supposed to exist in the most widely separated localities. One of these was supposed to be not far from Malacca, whilst in the Lenox globe-map (one of Dr. Ravenstein's series) it is applied to the north-western extremity of South America. This is one of the maps showing a large land south of the Indian Ocean, and in the Cracow globe of about the same date (1511), the geography of which is in most respects identical with that of the Lenox globe, we have a strange instance of the confusion in some men's minds in the labelling of this supposed land as "America noviter reperta" (America lately discovered). It is worth noting perhaps that a somewhat similar confusion prevailed as to the part of the world reached by the French voyager, De Gonneville, some thinking that he touched at a part of South America, others that he had reached a new land in the Indian Ocean. Such confusion is further illustrated by the Association of parrots (specially mentioned by the early voyagers as found in Brazil, and prominently represented there on the Cantino and many other maps) with a vast land to the south of the Indian Ocean, where a legend recalling their great abundance is to be found in much later maps. Now when we find that the land south of Schöner's supposed strait likewise bears the name Brazil; remembering too that he was one of the academic rather than the practical school of map-makers; we can hardly give much weight to his representation as a proof of the knowledge of a strait, more especially as he places the passage some 7° N. of the true latitude of Magellan's Strait, in 45° instead of 52°. The idea of a strait giving access to the great South Sea had been in men's minds since the latter's discovery by Balboa, and when no such passage could be found within the

tropical part of America, it was not unnaturally transferred to the more southern region.

We come now to maps embodying the results of Magellan's voyage. The material is perhaps not so ample as might be wished, not only because some of the most important maps of the period have been lost, but because reproductions of some of those known are not generally available. One that is bound to be of interest in connection with Magellan is the large map by Juan Vespucci of 1526, or only four years after the return of the *Victoria*, brought to light by Messrs. Quaritch in 1914, and now in the possession of the Hispanic Society of America. The description published by Quaritch shows that it embodied the main results of Magellan's voyage, as might be expected from its author's official position in Spain as pilot and cartographer, but no reproduction of the map has yet been published. However, in the well-known Ribero maps of 1529, with the very similar map of 1527 sometimes attributed to Nuño Garcia of Turin, we have excellent examples of the official Spanish cartography during the decade following the great voyage. They were produced in the hydrographical office at Seville, established, according to some, largely under the direction of the Reinels, who seem for a time to have taken service under the Emperor. The accompanying Map No. 8 is a copy of the part of Ribero's map showing southern South America and Magellan's Strait. It could hardly be expected that the intricate navigation of the strait could be shown with greater accuracy, at least in a general map of the whole world. The left-hand portion of the map represents the Pacific, now first portrayed as a result of positive knowledge. The greater part is a mere waste of water, the only land seen for the greater part of the voyage being a few small islets, the chief of which received the names San Pablo and Tiburones ("I. of Sharks"). To the west of the ocean we see the Ladrones—the first landfall in that direction of Magellan as of so many subsequent navigators, and further still the eastern part of the Archipelago—representing the Philippines where Magellan met his death, the Spice islands with Jilolo, Banda, and Amboina, whilst in the other half of the map we have Timor, whence Delcano in the *Victoria* struck boldly south-west across the southern Indian Ocean to return to Europe by the Cape, and so complete the circumnavigation. This map is also important, as marking the line of demarcation through America, with Spanish and Portuguese flags on either side, and by the definite guide it thus gives to the position in which it would be placed on the other side of the globe in the view of the Spanish government. By this time the Portuguese were disposed to acquiesce in this view, and in 1529 (the date of this map) acquired the supposed Spanish rights to the Spice islands by purchase, though it was ultimately found that they were really Portuguese all through. On the accompanying sketch (No. 10) the outlines of Ribero's map are superposed on those of a modern map, showing that the width of the Atlantic was given

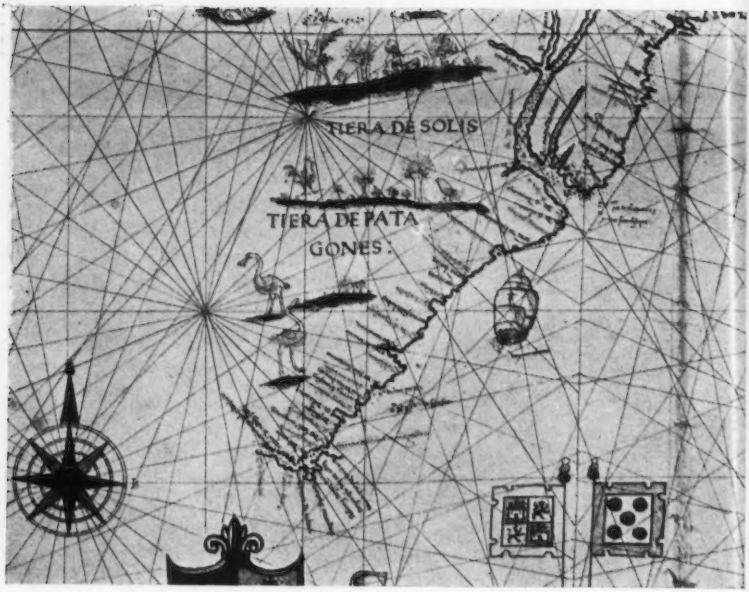
6. PART OF THE REINELS' MAP OF THE INDIAN OCEAN, CIRC. 1517, SHOWING THE RESULTS OF THE VOYAGE OF A. D'ABREU, 1511

The original extends somewhat farther east, and includes Jilolo.



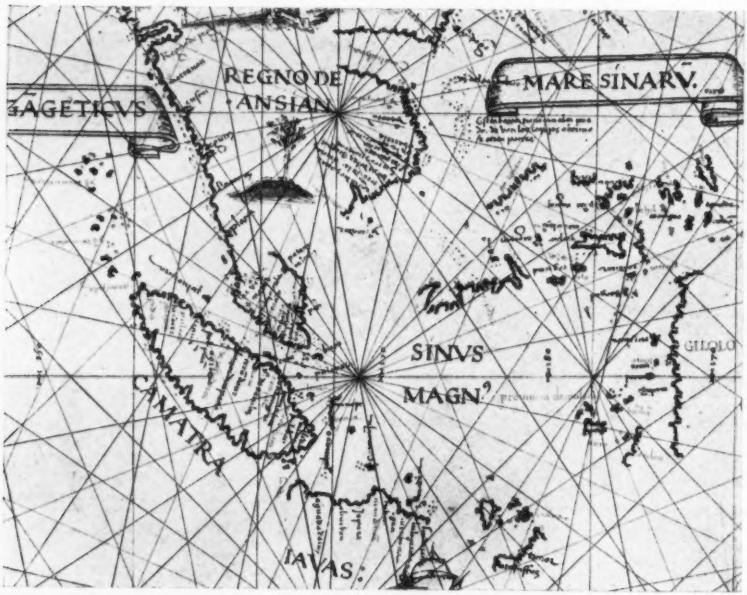
7. PART OF MAP OF SOUTH AMERICA, BY PEDRO AND JORGE REINEL, CIRC. 1516

(From Denucé's reproduction.)



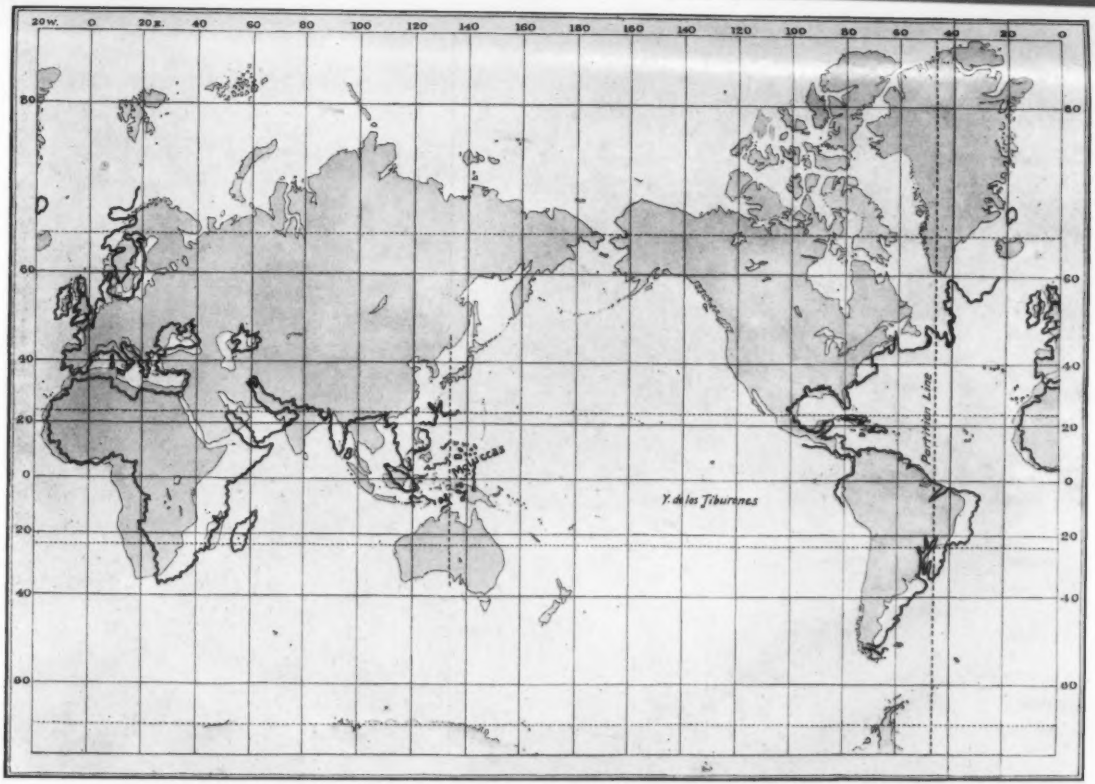
8. SOUTHERN SOUTH AMERICA AND MAGELLAN'S STRAIT FROM THE RIBERO MAP OF 1529. THE FLAGS INDICATE THE PARTITION BETWEEN SPAIN (TO THE WEST) AND PORTUGAL (TO THE EAST)

(*From the reproduction by William Griggs*, 1886.)

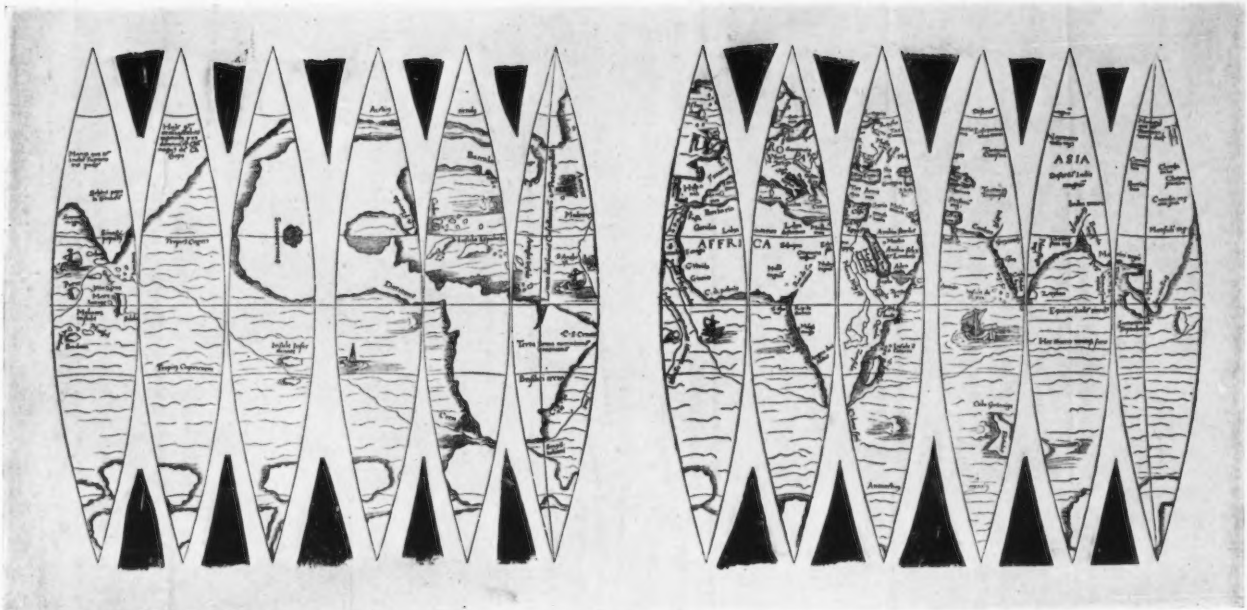


9. THE MALAY REGION IN THE RIBERO MAP OF 1529

(*From the reproduction by William Griggs*, 1886.)



10. OUTLINES OF THE RIBERO MAP, 1529, COMPARED WITH THE TRUE CONFIGURATION



11. GORES OF A GLOBE DOUBTFULLY ATTRIBUTED TO SCHÖNER, 1523, SHOWING MAGELLAN'S TRACK, AND THE LINES OF PARTITION IN BOTH HEMISPHERES

This Globe is copied in Holbein's picture, "The Ambassadors," 1533.

(From the facsimile in 'Johann Schöner' by Stevens and Coote, 1888.)

almost correctly (except in the north), but that the extension of the Old World was somewhat exaggerated, that of the Pacific somewhat reduced. Still the general correctness as regards longitude is certainly all that could be expected.

Another Spanish map, that of Alonso de Chaves compiled at Seville in 1536 as an authoritative version of all the new discoveries, is unfortunately lost, though a lately found Portuguese map by Lopo Homem, eighteen years later, is thought to represent it somewhat closely. Most of the maps of this official Portuguese cartographer are also lost, but, as Mr. Abendanon has shown in the *Geographical Journal*, probably gave a far better representation of the Malay Archipelago than any Spanish map of the time, the cartographical results of Magellan's voyage being but few as regards that Archipelago, apart from general world-maps like Ribero's. The best maps of the time for this part of the world are the French specimens of the Desceliers school, possibly based on Homem's.*

The next map (No. 11) is in the form of gores for a globe found at Munich in 1885, and described by the late Henry Stevens and C. H. Coote. It is interesting as actually showing the track of the *Victoria* round the world, as well as the lines of demarcation in the east and west. For a time it was thought to represent the lost globe made by Schöner in 1523, only the year after the return of the *Victoria*, but it has been shown pretty conclusively by Harrisse to be not the work of Schöner at all, and to be probably of somewhat later date. On the other hand, it has been shown by Miss Mary Hervey to have been the globe copied by Holbein in his picture of the Ambassadors, painted in 1533, so it is certainly no later than this date. By adhering to the academic representation of the Old World in longitude, it brings the whole Archipelago and part of the Malay Peninsula within the Spanish hemisphere, showing the maker to have been very much out of touch with actualities. Yet he errs in good company, for, strange to say, the official Spanish cartographer, Alonso de Santa Cruz, in his well-known map of 1542, so extends South-East Asia eastward that his "meridianus partitionis" in the East actually cuts the coast of Bengal just east of the Ganges, placing the whole of Further India in the Spanish hemisphere.

Whilst Ribero confined himself to actual discoveries and thus left blank the whole of the Pacific area not covered by Magellan's track, it was otherwise with other maps of the time. If the belief in a southern continent prevailed as it did before the great voyage, it seemed to gain confirmation from Magellan's passage through his strait, the island of Tierra del Fuego being taken for merely the northernmost extremity of the

* By the courtesy of Messrs. Quaritch the maps shown at the meeting included an interesting and undescribed MS. chart of the Archipelago, based in part on Magellan's voyage, and marking the supposed spot in the Philippines (themselves designated by the name given by Magellan—Archipelago de San Lazaro) where he met his death. It is unsigned and undated, but may perhaps belong to the class of lost Portuguese maps to which Mr. Abendanon has drawn attention.

supposed continent, which looms out in a more and more imposing form in the maps of the next half-century. We can here mention one or two only. The double heart-shaped map by the French geographer Oronce Finé brings it prominently into view by reason of the projection chosen, and marks it as "Terra Australis recenter inventa sed nondum plene cognita" (the Southern land lately found but not yet fully known). A part is still labelled Land of Brazil and another Regio Patalis, a legend which some have thought a corruption of the Land of Parrots of other maps, but which seems to be an inheritance from much older times. The Pacific has nothing like its correct extension, only 100° intervening between Magellan's Straits and Jilolo next the Moluccas (it should be at least 160°)—one more instance of the slowness of academic map-makers to adopt the results of practical men. The southern continent also figures prominently in the group of maps of the Dieppe school, by Desceliers and others, in which the makers have given further rein to their fancy by joining it to the "Great Java" in the region where Australia was ultimately to be found. The excellent representation of the islands of the Archipelago may here be noted. The great Southland is also a marked feature in all the maps of the Flemish school—*e.g.* in the World-map of Ortelius, one of those in which the abundance of parrots on the Southland is specially mentioned. The parts north of the Pacific, too, long continued to offer a field for speculation, and the belief first expressed in 1508 by Ruysch that North America was but the continuation of Asia to the north-east held its ground long after Magellan's voyage. An instance is the map of the Italian cartographer Gastaldi, in which America and Asia are joined in quite low latitudes, as they were also by Finé. It was not till towards the end of the eighteenth century that the separation of Asia from America was finally established by Bering.

Magellan's voyage left in fact much to be filled in—the whole Australian region as well as the whole of the lands on either side of the Northern Pacific. In spite of this a fairly correct idea of the relative extension of land and sea had now been gained, and in this respect no decided improvement on maps like Ribero's was reached till the time of the French geographer Delisle, nearly two centuries after the great voyage.

Before the paper the PRESIDENT said: It is very meet that we should come together from time to time to celebrate the great deeds of those who have gone before us, and who have laid the foundations of our science. This afternoon we celebrate the fourth centenary of that great circumnavigator, Magellan. Mr. Heawood will not give an account of his great voyage, but he will show in what way that voyage affected the map of the world. I will ask Mr. Heawood, who has, at brief notice but with great care, compiled a paper upon the changes in the map before and after Magellan's time, to give us his lecture.

Mr. Heawood then read the paper printed above, and a discussion followed.

Sir BASIL THOMSON: It must have struck everybody, I think, in listening to the paper, how curious it is that so many of the voyagers in the Pacific

managed to miss the greater groups. Magellan took a course which was afterwards taken by many other voyagers, and if you look at the map of the Pacific you will see he could not have devised his course better if he wanted to avoid dangers and get to the Philippines. You have voyage after voyage from 1525 onwards. Some of these voyages were disastrous because the crews mutinied. In 1537 you have Grijalva: one ship out of the expedition managed to get to New Guinea. In 1542 you have Villalobos; in 1555 Gaetano, and there is rather a curious history about him. He was the pilot to Villalobos's expedition, and in 1555 he discovered Hawaii; it is so believed owing to the finding of an old chart which is marked with the words "discovered by Juan Gaetano." In 1565 Lopez de Legaspe discovered the route to the Philippines, and we really owe to the voyage of 1567 the remarkable fact it was possible in those days to run an annual galleon to the Philippines with almost the accuracy of a Pacific liner. The reason was this. When Mendaña set out in 1567 and discovered the Solomon Islands he took the same kind of course. He found the Solomon Islands and there came the fatal day in the islands when he called a council of all his officers and suggested that they should set sail westwards like the remaining ships of Magellan's expedition. The pilots voted against it. If they had sailed westwards, in all probability Mendaña would have discovered Australia in 1567. It was almost chance that he did not. He left the Solomons and tried to work to the south-east. Then the crew nearly mutinied, and he consented to go north. He crossed the Pacific far north of the line, and when eventually he reached California, within two days his second ship, long believed to have been lost, arrived at the same anchorage. Anybody who has knocked about the Pacific in a sailing ship will realize what an extraordinary feat that was. It was the sailing north that made it possible to run the galleon. You cannot get back under sail unless you go north and pick up a north-west wind on the way back. This voyage illustrates the vicissitudes of geography. After the discovery of the Solomon Islands the tavern talk was that the islands were full of gold. There was no foundation for this beyond the fact they had discovered some stone-headed clubs rich in pyrites. Eventually they persuaded the Government to fit out a fresh expedition in 1595. Mendaña had placed the Solomon Islands 1500 miles nearer to Peru than they really were, and he discovered the Marquesas and Santa Cruz, and when he got to Santa Cruz he came to the conclusion that the New Hebrides were the Solomons. He died there, and the expedition went away north of the Solomons. The Solomon Islands then began to travel almost all over the Pacific. I think they were identified with the Marquesas, and even Dalrymple in 1790 denied their existence as separate from New Britain. They were re-discovered in 1767 by a Frenchman, Buache, just two hundred years after they had been lost. It was very interesting that several people visited them, but it remained for the man at the study table, and not the discoverer, to identify them. Years after they had been re-discovered a Frenchman sat down and re-established the fact that the Solomons had been re-discovered two hundred years after they had been lost.

Mr. GLANVILL CORNEY: As one who has experienced the thrill of handling some of the original documents written by men who sailed in the ships of Magellan's days, it is with particular pleasure, though not without much diffidence, that I avail myself of your invitation to add a few words to the very lucid and important paper which we have just heard from Mr. Heawood. I will refer only to one aspect of those discoveries, one which has reference not so much to the East Indies as to the Strait. For many years after Magellan had

passed through the Strait from east to west very little use was made of it, and not until thirty-seven years afterwards was it ever explored from west to east. But at that time Ladrilleros and another navigator or pilot called Ogea, whose manuscripts I have seen, were appointed to sail from Valdivia down the coast of Chile and Patagonia, and explore the strait Magalhães had discovered, from west to east. But it was very little used by shipping either from west to east or east to west for many years, although one or two expeditions were sent out from Spain to survey it. It was felt to be too remote, and its navigation was too dangerous. The climate was too rigorous, and the time occupied was such that the crews were very apt to be overtaken by scurvy, and altogether it did not serve the practical needs of the ships of that time; so that at least four projects for facilitating the conveyance of people and merchandise across the isthmus of Central America were presently discussed. One route crossed from Nombre de Dios; to Panamá one through the isthmus of Nicaragua and across the lake; another through the isthmus of Tehuantepec; and one from the north side of Darien to the gulf of San Miguel. But the more interesting point to which I would now refer is that it was really the discovery of Magalhães' strait, and the difficulties that were found to attend its passage by ships, that laid the foundation for the great modern triumph of engineering that we see to-day in the Panama canal in full working order. In 1527 steps were taken to clear the impediments in the bed of the Chagres river from its mouth up to the head of the navigable portion, which was a distance of about 12 leagues, and it was found that from that point to the coast on the Panama side involved a cart road of another 7 or 9 leagues. As an alternative to this plan proposals were submitted to the Emperor Don Carlos V. for the canalization of this track, and in 1534 His Majesty actually directed that the locality should be surveyed with that object in view—that a report should be drawn up and submitted to him setting forth the most suitable and economical means for establishing a communication between the head of the navigable portion of the river and the ocean on the west, the difficulties likely to be met with in executing such a work, whether on account of different tides, as was suggested by some people, or by reason of the irregularities in the surface of the land and its levels. His Majesty further called for a careful estimate of the expenses that the scheme to be most recommended would entail in men and money, and desired to be informed of the time that its execution might be expected to occupy. So that we have to go back to the year 1527 to get at the first suggestion for the construction of a canal across the isthmus of Panama; and that was a direct result of Magalhaes' discovery. The despatch embodying these commands from the Emperor was dated 20 February 1534, and was immediately sent out to the Governor of Panama. The Governor at that time was Don Pascual de Andagoya, and he viewed this proposal with disfavour; but while promising to see the orders of the Emperor carried out as far as practicable in the course of the ensuing spring, he considered that His Majesty must have been advised by counsellors of little talent, and persons who had no knowledge whatever of the local conditions or climate or topography. He even assured the Emperor that the world contained no prince, howsoever puissant, equal to the task of uniting the two seas, even with the aid of the native inhabitants of the country. Some persons deprecated the idea because, they alleged, the levels of the Atlantic and the Pacific were not the same; saying that the first effect of a canal would be to flood the adjacent countryside. Fifty years later Padre José de Acosta, the historian of the Indies of that date, observed that be that as it might, it merely seemed to his poor ability that no human agency could suffice to break through

the mighty wild of rocky fastnesses and the impenetrable forests that God had set between ocean and ocean, and which had continued for untold ages to successfully resist the fury of their waves. What might the good Padre not have said could he have been present to witness, the other day, the passage of His Majesty's ship the *Renown*, bearing upon her decks the world's most puissant Prince, quitting the waters of the Atlantic to-day and entering those of the Pacific to-morrow!

Sir ALBERT GRAY: One of the sad experiences of advancing years is that we find what we were taught in our youth as facts become dispelled subsequently as myths and illusions. I had such an experience a week or two ago reading a most interesting book entitled 'Russia in the 'Eighties' by Mr. Baddeley, and there one of my illusions was dispelled. I had been told in my youth that in Russia wolves used to attack travellers in packs, and I remember well such a scene in a picture with the pack of wolves surrounding a sleigh and the unfortunate occupants tossing out their remaining food in order to get rid of the wolves. Now Mr. Baddeley comes along and tells us that this is a mere myth—that the wolves do not go about in packs, but roam in ones and twos. Mr. Heawood disperses another of those myths, and we now are told that it is entirely an error to suppose that the Pope Alexander VI., as an arbitrator, divided the world between Spain and Portugal by an imaginary line. One is rather loath to give up this illusion, but it seems to me there is just a trifle of reason in the foundation for it. One must admit that Pope Alexander did not act in the matter exactly as an arbitrator, his decision being given solely on the claim of Spain, and the awards to Portugal having been made by previous popes. Both the Portuguese and the Spaniards seem to have considered that to have a Papal Bull in your pocket was a fairly good title-deed. Accordingly first the Portuguese went to Rome, and obtained a Bull giving them all the discoveries as far as the Indies. Then the Spaniards came to Pope Alexander, and he gives them, apparently, the first Bull of 1493 confirming to them (under conditions) the discoveries of the Western ocean. Somebody seems to have brought it to the pope's notice immediately after the Bull was issued that this might interfere with the previous Bulls in favour of Portugal, and accordingly the very next day (if the Bulls were in fact issued on the dates assigned to them) the second Bull was promulgated fixing the 100-league limit, so although the pope gave those Bulls not as an arbitrator, but as a supreme authority, yet he was bound to consider that the various Bulls should not be inconsistent; and therefore he did what was the nearest thing to arbitrating between the two Powers, and fixed the 100-league limit. That decision, as we know, was unsatisfactory to Portugal, and the result was the Treaty of Tordesillas in the following year. I cannot claim to offer any observations on the actual history of cartography as has been so lucidly explained to us to-day by Mr. Heawood and in the speeches of my friends Sir Basil Thomson and Dr. Corney, but it occurs to me as an outsider how extremely probable it is that when an imaginary land gets on to a map it remains there for a long time before it is finally got rid of, and also that these various maps were probably not made in large numbers, and that in some cases the map-maker would know perhaps some only of the discoveries and not others. I only wish to thank Mr. Heawood most heartily for his most interesting and lucid paper.

The PRESIDENT: It made one's mouth water to see the series of maps which were put on the screen, and to note the number of blank spaces there were upon them which needed exploration. Nowadays there are very few blank spaces left, and we geographers are hard put to it to know where to go.

But four hundred years ago, in Magellan's time, one can imagine the joy with which those old sea captains put their heads together and thought over the great voyages which might be possible. To-day we would like to put once more on record the grateful memory in which we hold the magnificent services which Magellan rendered to geography. Mr. Heawood has well shown both what there was to be discovered, the amount of unknown sea and land in his time, and what his voyages enabled cartographers to fill in, and I am sure you would like me to thank on your behalf Mr. Heawood for collecting so many interesting facts regarding the great work of Magellan.

FOUR NOTES ON MAP PROJECTIONS

Read at the Afternoon Meeting of the Society, 14 *March* 1921.

Note on a Doubly-Equidistant Projection

Colonel Sir CHARLES CLOSE, K.B.E., F.R.S., Director-General of the Ordnance Survey

WE most of us know that when it is desired to ascertain from a small-scale map or atlas the distance between two points, the only correct way is to find from the map the latitude and longitude of the points and make a small calculation. But in practice, owing to the weakness of mortal nature, nobody does this, and we take a scale or pair of dividers and measure the distance between the points. It occurred to the writer that it might be interesting to acknowledge this human failing, and to choose a map projection in which the two straight-line distances between any arbitrary point and two previously fixed points should always be correct. The two fixed points may be, for instance, the starting and ending points of a voyage, and on such a projection, however the traveller may deviate from the shortest path, he will always be able to find, by direct measurement, how far he is from his home and how near to his goal.

It at once follows, from the definition of the projection, that the great circle joining the two fixed points is represented by a straight line true to scale throughout its length. Having drawn this straight line, the construction of the projection is easy: for each point of known latitude and longitude calculate the spherical or spheroidal distances to the fixed points, and the intersection of these rectified distances, measuring from the fixed points, will give the position of the required point on paper. The two systems of small circles, of which the two fixed points are the poles, are represented by concentric circles spaced at their true rectified distances.

In the special case in which the Pole of the Earth is one of the fixed points, the parallels of latitude are represented by concentric circles spaced at their true distances. The meridian passing through the other selected point is represented by a straight line true to scale throughout its length. As regards the other meridians, if the latitude of the other fixed point,

Q, be ϕ, and λ, L, be the latitude and longitude of any other point X, then, on the spherical assumption, the position of X on paper is found by the intersection of $90 - \lambda$ measuring from the Pole, with a measuring from Q, where

$$\cos a = \sin \phi \sin \lambda + \cos \phi \cos \lambda \cos L$$

L being a constant for any particular meridian.

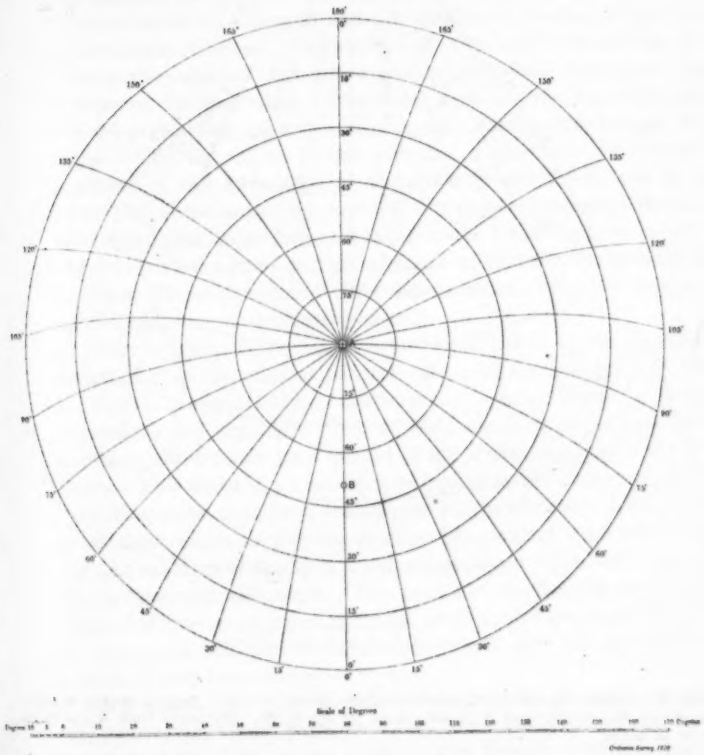


Fig. I.—Doubly-equidistant projection with centres A (North Pole) and B (London) 51° N.

Fig. I. shows a doubly equidistant projection with the Pole as one point and a point of latitude 51° N. the other.

Fig. II. shows a doubly-equidistant projection in which the two fixed points are New York and Land's End. By the use of this latter projection the traveller across the Atlantic can always obtain, by direct measurement from his map, the distances he is from these two places, however much he may be blown out of his course.

Reverting to Fig. I., by the use of this projection it is easy to solve graphically for any particular place, whose latitude is that of B, certain

elementary problems in spherical trigonometry. Thus, given the declination and altitude of a star, its hour-angle can be read off; or, by calling

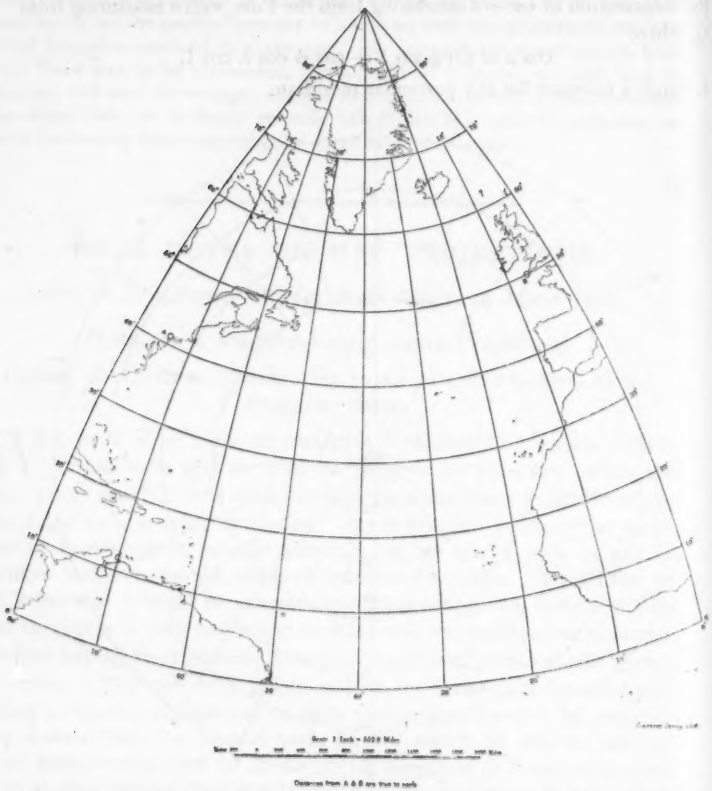


Fig. II.—Doubly-equidistant projection of the North Atlantic Ocean: centres A (New York) 40° N., 74° W., and B (Land's End) 50° N., 6° W. Distances from A and B are true to scale.

A the zenith, given the declination and altitude, its azimuth can be obtained, and so on.

On the Projection adopted for the Allied Maps on the Western Front

ARTHUR R. HINKS, C.B.E., F.R.S., Sec. R.G.S.

FRENCH military maps had always borne on their corners the rectangular co-ordinates referred to the Panthéon as origin, from which the use of the "grid" arose quite naturally. But as the projection employed was that of Bonne, in which meridians other than the central are not ortho-

gonal to the parallels, the system was ill adapted for the modern co-operation between survey and artillery. This defect was recognized very early in the war, and a new kilometric grid (carroyage) was introduced, for which extensive lithographed tables were provided, with the title "Tables de Projection (Système Lambert)."

On the unification of the Allied command in the spring of 1918, it was ordered that all the Allied armies should use the system of map reference based on this grid, and the minutiæ of its calculation became of immediate interest. Examination of the brief introduction to the French tables showed that they were computed from expansions limited to terms of the third order. The tables were to seven significant figures, and the preliminary quantities used in their construction to eight or nine figures. This degree of formal accuracy is of course far beyond the exactness of our knowledge of the figure of the Earth, and is purely formal, but at the same time essential. It is, however, very difficult, even with eight-figure logarithms, to reproduce a literal agreement with the tables to the last figure; and the slightest variation in the formulæ or the constants adopted produced discordances which, without being of real significance, were fatal to convenience.

Some accident which I cannot now recall made me interested in the subject during the summer of 1918, and with the assistance of Mr. A. E. Young I examined the discrepancies arising when the complete expressions for Lambert's Conical Orthomorphic projection with two standard parallels were used instead of the approximations of the French tables. This was with no intention of criticizing the French tables, which were accepted as definitive; the purpose was to show that it was necessary to use these tables as they stood, since independent calculation with the slightest variation of theory or constants could not reproduce them, or give results consistent with them. The results of this inquiry were not published, but a certain number of the pamphlet containing them were printed in June 1920 and distributed to those who might find the question of interest, if only historically.

In November last Colonel Bellot, director of the Service Géographique de l'Armée, very kindly wrote me a long letter which throws an interesting and unexpected light on the matter. The French "Système Lambert" was not intended to be precisely Lambert's Conical Orthomorphic with two standard parallels, but Tissot's projection of minimum deformation for a zone between parallels.

Tissot, remarks Colonel Bellot, has given the general formulæ of projections which possess, to the exclusion of all others, the double property of producing only alterations of angles of the third order and alterations of length of the second order. He could have pushed the developments further so as to reduce still more the alterations of angle, and even render them nil, but that would have complicated the equations without appreciable advantage. His general projection is then ortho-

morphic to the third order approximately. The equations contain two arbitrary constants which, with the position of the origin, are determined so as to reduce to a minimum the deformations of length over the extent of the surface to be represented. When this region has the form of a zone, if one determines the constants by the condition that the axis of y of the projection represents the meridian, and that the alteration of lengths is the same for all points at the same distance from the parallel through the origin, to the second order, one obtains precisely the equations of Lambert's conical orthomorphic projection limited to terms of the third order. That is why it has been called the "projection de Lambert." In reality it is not the Lambert projection, but only a projection very close to it.

This very interesting explanation not only clears up completely the questions which remained a little obscure, but makes it necessary for us to reconsider the view which has been taken in England of the work of M. Tissot. His 'Mémoire sur la Représentation des Surfaces et les Projections des Cartes Géographiques' (Paris: Gauthier-Villars, 1881) deduces from analytical considerations of the utmost generality certain formulæ involving two arbitrary constants, that have to be determined for any particular map by a process that looks tedious at first sight, and has not, as far as one knows, ever been applied to the construction of an actual map. For the particular cases of a zone and a "fuseau" M. Tissot shows that the formulæ are much simplified, but he does not, I think, point out that they reduce essentially to two well-known projections: the Lambert Conical Orthomorphic and the so-called Gauss Conformal. Still less does it seem to be generally realized that his general projection is to the third order of small quantities the same as the stereographic, as Colonel Bellot says.

Viewed in this light the projections of M. Tissot assume a new aspect, and it is clearly necessary to study them anew, and to master his rather repellent terminology, that seems so superfluously different from that of his compatriot Germain.* The interesting question will then arise: If considerations of a perfectly general kind lead to the conclusion that three well-known projections are, to the third order, equivalent to the best possible projections in the circumstances, is there any advantage in

* In the terminology of Tissot, Autogonale means orthomorphic, Authalique means equal-area, Aphylactique means neither orthomorphic nor equal-area, Automécoïque lines preserve their true lengths, Atractozonique projections preserve the areas of zones and fuseaux, though they are not authaliques.

Other unfamiliar terms are épicylindrique, épiconique, méricylindrique, tronconique, périgonal, périhalique, périmécoïque, which are more difficult to define briefly. When the terminology is mastered one speaks of Sanson's projection as the "méricylindrique à meridien moyen et parallèles automécoïques"; Albers' conical equal-area is the "tronconique authalique"; and Mollweide's is the "méricylindrique authalique à méridiens elliptiques." Perhaps the obscurity of this language is responsible for the fact that forty years after its publication the very interesting work of Tissot is not better known.

abandoning those projections nominally, in favour of close equivalents that have no clear geometrical significance? Shall we not conclude rather that the modern preference for the Conical Orthomorphic of Lambert, and the Gauss Conformal or transverse Mercator, is supported in the strongest way by Tissot's investigations, and that they may be employed with reinforced confidence under their habitual names? The idea that the Stereographic is the best projection for a map of equal extent in latitude and longitude is not, I think, supported by recent practice, but clearly requires examination.

The thanks of all interested in the subject will be given to Colonel Bellot for his very important explanation of the ideas underlying the "Tables de Projection (Système Lambert)," that were destined to play an essential part in the operations of the Allies, had not other causes precipitated the victory.

A Modified Rectangular Polyconic Projection

G. T. McCaw

The common rectangular polyconic is designed to give the scale true on the equator. The scale errors on the meridian and parallel, to terms of the second order, are:

$$\text{Scale error in direction of meridian } +\tfrac{1}{2}\omega^2 \cos^2 \lambda$$
$$\text{,, ,, ,, ,, parallel } -\tfrac{1}{4}\omega^2 \sin^2 \lambda$$

where λ is the latitude and ω the longitude from the central meridian.

Now it is not difficult to reduce the scale error on the parallel. If the scale is made true on a parallel central to the map, instead of the equator, the scale error on the parallels generally will be reduced. But this is nothing but a partial improvement, since it leaves the scale error on the meridians unaffected.

It then becomes a question whether the scale error on the parallel could be brought up to the scale error on the meridian, thus making the projection orthomorphic; we could then reduce the scale error over the whole map by making use of a scale factor in the ordinary way. Now orthomorphism had been already obtained by Lagrange, whose projection had therefore to be investigated.

The Lagrange projection involves some elegant geometry, but it has peculiar properties. The projection, as regards scale error, is somewhat lop-sided, in that it introduces a scale error on the meridian and the line of zero error is a curve whose equation is not simple; this, however, is no fatal objection to a representation otherwise excellent. A point of even less importance in general is the fact that the northern and southern hemispheres are not symmetrical. Geometrically, the projection is not difficult to construct; but, as is well known, geometrical nicety of construction does not necessarily imply practical convenience for the map-maker; indeed,

experience proves rather the opposite. A good example is furnished by the rectangular polyconic itself: O'Farrell's construction is geometrically very neat, yet not of much practical value. The real objection, however, to the Lagrange is its lack of adaptability to the construction of general tables; each map demands a computation for itself. In fact, in this sense it is a better projection for the surveyor than the cartographer.

The writer was thus led back to the common rectangular polyconic. An orthomorphic form, indicated by J. I. Craig in another connection, was suggested to the writer by A. E. Young, and, suitably modified, proved fruitful. To explain this, some mathematical relations of the projection are unavoidable.

The equation of the meridians in the common rectangular polyconic is

$$\tan \tfrac{1}{2}\gamma = c \sin \lambda$$

where γ is the convergence or angle of the cone, and c is a constant *which must not involve the latitude*, though it may be any suitable function of the longitude. This c in the common form is $\frac{1}{2}\omega$ in radian measure.

Now supposing that we take

$$\tan \tfrac{1}{2}\gamma = \tfrac{1}{2}\omega \sin \lambda\{1 + \tfrac{1}{12}\omega^2(1 + \cos^2 \lambda)\}$$

we shall obviously have a projection which violates the condition above; we shall, in fact, have an orthomorphic projection which may be described as approximately polyconic.

Suppose, however, that in the term within the brackets we put $\lambda = \lambda_1$, where λ_1 is constant and equal to the latitude of the central parallel of the map, while λ outside the brackets remains unchanged; the polyconic condition will obviously not be vitiated. This, then, is the modification adopted. It leads to a rectangular polyconic which is approximately orthomorphic, and which is almost truly orthomorphic on the central parallel.

The scale errors on this modified polyconic are, to terms of the second order:

On the meridian	...	...	...	$+\frac{1}{2}\omega^2 \cos^2 \lambda$
,, parallel	...	...	...	$+\frac{1}{2}\omega^2(\cos^2 \lambda + \cos^2 \lambda_1)$

It remains to consider whether the modified projection can be set out from general tables. If xy, $x_x'y'$ be respectively the co-ordinates of the common rectangular and the modified rectangular projection, it is found that for the ordinates

$$y' = y\{1 + \tfrac{1}{12}\omega^2(1 + \cos^2 \lambda_1)\}, \text{ very approximately}$$

This contains λ_1 as a constant for the map, so that we may tabulate the fractional increase of the y of the common rectangular polyconic against the longitude as argument, and in the row representing the mean latitude of the map.

The main portion of the x co-ordinate is given in the column under longitude o°, and is therefore the length from the origin measured on the

central meridian to the parallel of the latitude of the points. The remaining part of the x co-ordinate is the arc-versine of the point, that is to say, the offset from the perpendicular to the central meridian at the latitude of the parallel of the point.

Now in the modified rectangular this offset is found to be increased in the ratio

$$\tfrac{1}{6}\omega^2(1 + \cos^2 \lambda_1), \text{ approximately}$$

that is, the offset is increased in just double the ratio of increase of the ordinate.

It is evident, therefore, that it is necessary to tabulate a single modifying factor only, applied directly to the ordinate y and doubled before being applied to the offset, which is that part of the abscissa x which represents the arc-versine.

The following table shows the reciprocal of the scale error on the meridian parallel of the modified projection when the central parallel is in latitude 45°.

Lat.	15°		30°		45°		60°		75°	
Long.	Mer.	Par.	Mer.	Par.	Mer.	Par.	Mer.	Par.	Mer.	Par.
15°	31	41	38	47	59	60	115	81	430	109
20°	17	23	21	27	32	33	64	47	241	65
25°	11	15	14	17	21	22	41	31	154	44
30°	8	10	9	12	16	16	28	23	107	33

The exaggeration of scale can never be reduced by a scale factor. We give the preference to that factor which makes the scale error (positive) at the right and left margins of the map equal to the scale error (negative) on the central meridian, since this reduces the maximum scale error to the least possible. If ω_2 be the longitude of the margin of the map, reckoned from the centre, the longitude of the standard meridians will then be ω_1, where

$$\omega_1 = 0{\cdot}707\omega_2$$

In the example above, for a longitude of $25° = \omega_2$, we must then take $\omega_1 = 17°\ 40'$. Accordingly, the reciprocal of the scale error now becomes—

Lat.	30°		45°		60°	
Long.	Mer.	Par.	Mer.	Par.	Mer.	Par.
0°	− 43	− 43	− 43	− 43	− 43	− 43
15°	+466	−404	−158	−147	− 68	− 90
17° 40′	+ 83	−182	0	0	− 87	−150
20°	+ 45	+ 74	+145	+179	−123	−435
25°	+ 21	+ 30	+ 42	+ 48	+1612	+121

The means of the errors on the meridian and parallel are found to be very nearly the same as the Lagrange projection. Compare the errors

with those in the common rectangular polyconic; it is sufficient to give the results for longitude 25°.

Lat.	30°		45°		60°	
Long.	Mer.	Par.	Mer.	Par.	Mer.	Par.
25°	+14	−84	+21	−42	+42	−28

Thus, while the modification here indicated reduces the scale error by nearly one-half, it at the same time has the effect of rendering the representation nearly orthomorphic.

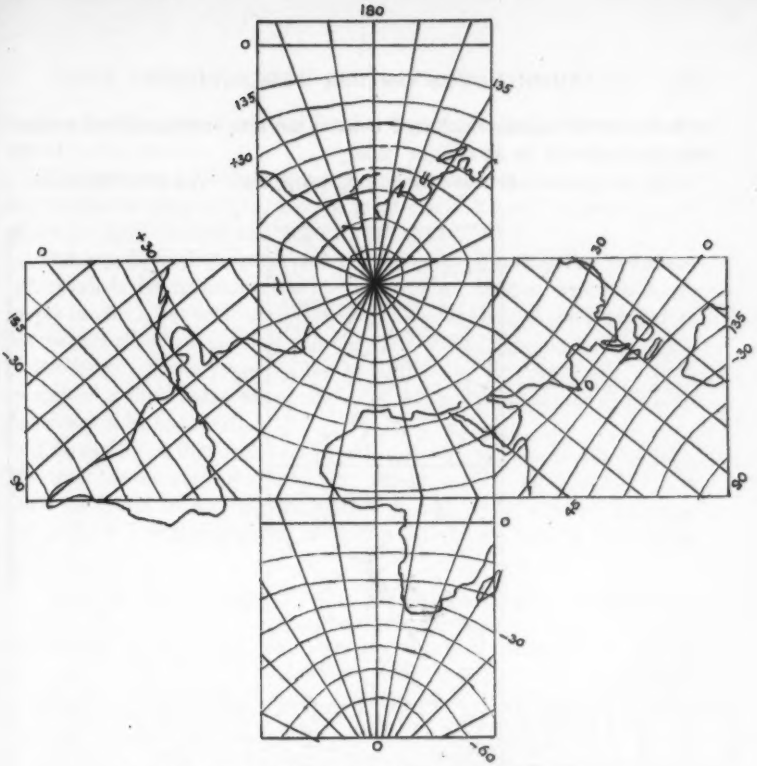
The modified projection is suitable for a meridional rather than a longitudinal configuration, but for areas whose total width does not exceed 40° of longitude it seems to be little, if any, inferior to the best forms of representation where the meridional extent is also considerable. The scale error is very much the same as that of the Transverse Mercator (Gauss Conformal). It would form an excellent projection for a general map of Egypt and the Anglo-Egyptian Sudan, or a country of similar proportions.

The Projection of the Sphere on the Circumscribed Cube

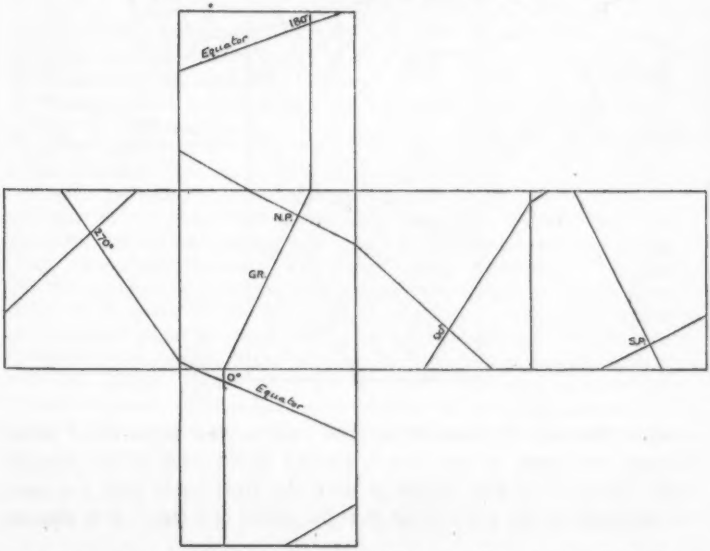
ARTHUR R. HINKS

THE projection of the sphere on a circumscribed cube was, according to D'Avezac, first used by Reichard in a work published at Weimar in 1803. The poles were at the centres of two opposite faces. A small sketch of a projection on the cube touching the sphere at 30° N. and 100° W. was given by G. A. Schott in the Reports of the United States Coast and Geodetic Survey, Washington, 1882, and is reproduced in the writer's book on 'Map Projections' published by the Cambridge University Press, though by a regrettable oversight there is no acknowledgment of the source. In this example the meridian through the above point is drawn parallel to the edge of the face. Similar projections of the celestial sphere have been used by the writer for studying the galactic distributions of star clusters and nebulæ (Monthly Notices, R.A.S., vol. 71, p. 693). In all these examples the poles were placed in the median line of a face. It will be convenient to call this class the "inclined" projections on the cube, reserving the term "oblique" for the class in which the pole is not on the median line of a face.

The Washington projection referred to above cuts up the continents very awkwardly, and the same thing happens if one draws an inclined projection with London at the centre of a face. But by giving the cube a suitable obliquity it is possible to get a map of the world in which the principal land-masses are fairly well disposed on the faces of the cube,



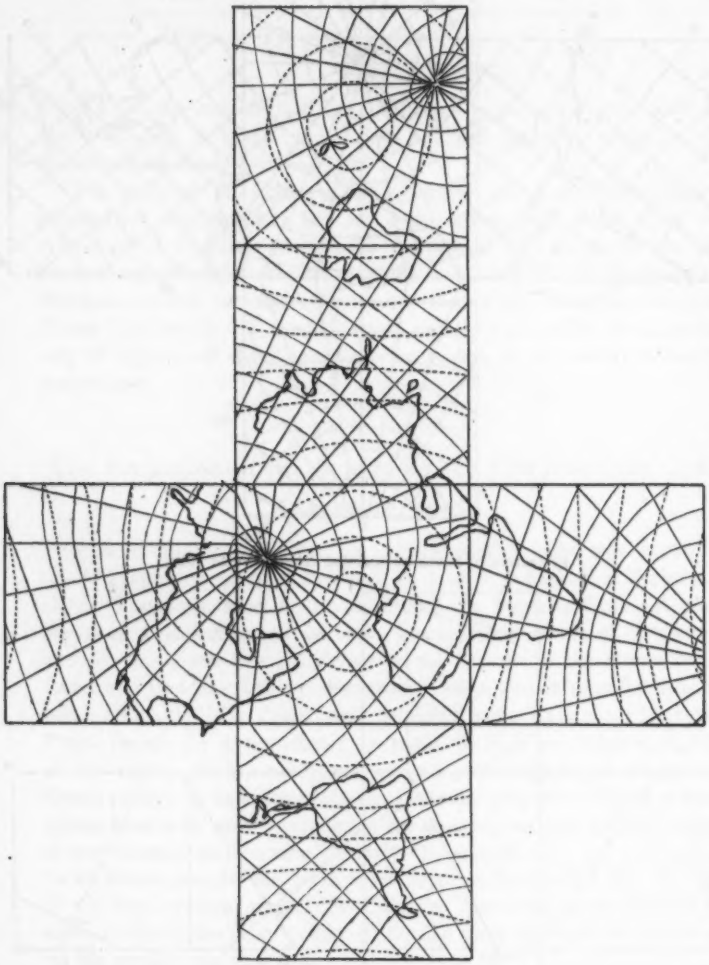
Projection of Earth on inclined circumscribed cube.



Preliminary construction of equator and meridians on oblique circumscribed cube.

as in the sketch below, which is, I believe, the first example of the world map gnomonically on an oblique cube.

The projection has some interesting properties. All great circles are



Projection of Earth on oblique circumscribed cube, with circles of equidistance from London at each 1000 miles.

straight lines on the faces of the cube; and a great circle which passes through the centre of one face is parallel to the edge of the adjacent face. Hence it is very simple to draw the great circle from any point of the world to the place which is at the centre of a face. It is also not

hard to draw the circles of equidistance from that place: they are shown dotted on the sketch.

The great circle joining any two points whatever of the sphere can be constructed quite simply, and the great circle distance measured, as is shown in 'Map Projections,' pages 42 and 46.

The accompanying sketch has no claims to accuracy, the meridians and parallels being constructed by a graphical process which is fairly simple to effect, but tedious to describe. The outlines of the land masses are roughly sketched to show that they fall well in relation to the edges of the faces. If the projection is ever redrawn, the north pole should be shifted a little more to the right, when the representation of Central America will be improved.

I do not know that such a projection has any very useful applications. The time has hardly come for laying out great-circle air routes. But it might be useful in showing the ranges of high-power wireless stations; and anyhow it makes a rather attractive little world map of an unusual kind.

Colonel Sir SIDNEY BURRARD: As I have no technical knowledge of this subject, I find it rather difficult to follow three of the foremost experts and to say anything of use. I can speak only from the purely map-making point of view. Sir Charles Close has put forward a new projection, and he has explained it with that lucidity which has characterized all his writings, but I did not realize until Mr. Hinks spoke of it that it was the beginning of a new class of projection. It will probably in future be known under the name of "Close's Projection." As far as I understand, Mr. McCaw has made a new modification of an old projection. I think he has introduced an arbitrary change, and I understand the justification for that is that he has reduced the errors. It would be very interesting to distant readers who are unable to be present this evening if, in dealing with his errors, he could also give them in terms of the errors we generally employ in mapping. We know we can plot to within one-hundredth of an inch, and draw a pencil line to within one-eightieth part of an inch, but I do not know what magnitudes of error Mr. McCaw was dealing with from the mapping point of view. With reference to his arbitrary change, when I have had to attend conferences on this subject I have met with certain projections which are called "quasi," and I have never quite known what "quasi" meant. One of our projections in India is called the "quasi," and our mathematical adviser told us that the mathematicians apply the word when they have been doing something which is not quite above board. As Mr. McCaw has introduced a modification, I thought I would take the opportunity of asking, "Is it 'quasi'?" Mr. Hinks greatly excited my interest when I saw he was reading a paper on the projection used by the Allies, but he did not tell us what was the solution of the problem—that the Artillery wanted a map covered with squares. Many years ago we were called upon to cover the Punjab with squares. If two lines on the surface of the Earth are parallel they cannot both be straight, and if they are both straight they cannot be parallel. Is the Artillery problem the same?

Colonel E. M. JACK: The only thing I would say is that it was not simply a matter of covering a map with squares, but providing a complete system of co-ordinates all over the area. We started with an arbitrary system of squares

based on each sheet, which was useful for identifying a point. What we wanted was a complete system of squares all over the area, independent of the sheets, and based on the system of co-ordinates.

Colonel Sir CHARLES CLOSE: Mr. Hinks mentioned the difficulty of finding an English name for "fuseau." I do not know if "gore" has been used.

Mr. HINKS: Yes.

Colonel Sir CHARLES CLOSE: Years ago I was serving on the Balloons, and we always called these things "gores." It is a possible word. I was very interested in Mr. McCaw's paper, and I should like to ask one question: Is the projection specially devised for a series of maps such as the ordinary polyconic, or devised for one sheet? At the bottom of the investigation is it intended to provide a series of sheets so that you may make up tables; or is it intended for one large sheet embracing the equator?

Dr. EVANS: May I ask if the word "lune" has been used?

Mr. HINKS: That again is a word which has never been taken on. It is the correct geometrical word, but it has never found favour.

Colonel H. ST. J. WINTERBOTHAM: I think, if I may make bold to do so, I will plunge into the gap left by Colonel Jack on the question of what the gunner really wants in the way of co-ordinates. The position of any heavy gun is properly surveyed on the ground. The position of the target to be hit is also surveyed. Those two positions are defined by rectangular co-ordinates, preferably in some projection which provides a minimum of angular distortion without introducing noticeable changes of scale. One wants, therefore, an orthomorphic system of co-ordinates, and the reference squares on the map should be defined by lines which are parallel to the axes of those co-ordinates. I will just add one word as to Mr. Hinks' most interesting paper on the Lambert Conical Orthomorphic. I think it is a very curious thing we never understood in France that the projection actually in use was due to Tissot. When British and French troops were despatched to Italy in 1917 the British troops were without equipment for either survey on the ground or reproducing maps, but were fortunate enough to secure in Paris a large number of French squared maps which had been specially prepared for that front. We found out then that the French intended using there a Lambert Conical Orthomorphic projection with one standard parallel. From that day for two months the French representative of the Service Géographique in Italy and myself saw little of each other. During these months the French, ourselves, and the Italians all computed the positions of the geodetic points in the Venetian Plain upon Lambert's Conical Orthomorphic with one standard parallel, and each worked on first principles. It was naturally rather pleasant to find at the end of it we had come to no substantial disagreement, but all of us, in that case, regarded it as a Lambert Conical Orthomorphic.

Lieut.-Colonel A. J. WOLFF: The projection described by Mr. McCaw is very ingenious and interesting. During the war, partly owing to the lead of the French and partly on account of the claims of the artillery, orthomorphic projections attracted considerable attention. Orthomorphism is however only local on a map. Is it therefore worth while to strive after approximate orthomorphism at the expense of other definite properties and simplicity of construction? What Mr. Hinks has told us about the French map projection is exceptionally interesting to me. When we were scoring the Lambert grid on our war maps in 1918, the slight difference from the formulæ of Lambert's second projection puzzled me considerably, and the explanation given by Mr. Hinks comes as a complete surprise to me.

Colonel TANDY: Sir Sidney Burrard has referred to our difficulties in India. The General Staff wanted us to extend one system of rectangular co-ordinates indefinitely all over India, or at all events over the whole of the North-Western Frontier. This is impossible, and the only system I was able to suggest for all India was to use our degree-sheets, which are bounded by one-degree graticules, as a basis, and then to subdivide these into minutes and decimals of a minute. I do not know if the question has been decided in any way since I left India, but it is very likely to be heard of again, and if experts present will turn it over in their minds we may be very glad of their advice later on.

Mr. REEVES: Sir Charles Close's new projection is likely to prove very useful in many circumstances, and in my work of instruction I welcome it as providing a ready means of solving approximately problems in spherical trigonometry. It is important to be able to check readily the computations of pupils, and see that they are not committing any serious errors with their work; as, for instance, in the computation of the hour angle from an observed altitude. For this purpose I frequently use, at present, a large globe or a special arrangement of two similar projections, the upper one of which is transparent and revolves on the other; but this new projection would, I imagine, be better in many respects. What is needed now is that some one should work out the co-ordinates of the projection for a few of the more useful cases, so that a draughtsman could easily and accurately construct it to any scale.

Mr. MCCAW: With regard to Sir Charles Close's question, the custom in the Geographical Section of the War Office has always, I think, been to limit the rectangular polyconic projection to a single sheet of a small-scale map. When the scale is comparatively large, say 1/250,000 for serial maps, there is no appreciable difference between the common and rectangular polyconic. Sir Sidney Burrard has asked if the projection I have described is a "quasi." That is not so; but after all I do not think there is any great objection to the use of this word in general, provided that its meaning is properly understood. A name like secant conical is descriptive merely, but to prevent any one from supposing that points on the sphere are projected orthographically on the secant cone, the qualifying word "quasi" or "so-called" is often added. The projection of which I have spoken remains rectangular and polyconic after modification, and no qualifying word is wanted. I should like to take advantage of this opportunity to ask a question as to the cadastral sheets of India. In that vast country, at least six origins of cadastral systems would be required. But the Indian Survey went further and made an origin, as I understand, at the centre of each square degree. I should like to know whether or not this is the case, and whether the cadastral sheets are square.

Colonel TANDY: All our cadastral maps in India are based on rectangular co-ordinates, and have rectangular sheet-lines. The work is generally done by districts at the time when the districts come under settlement, and separate origins are usually taken for each district.

Colonel Sir SIDNEY BURRARD: One question I forgot to ask Mr. McCaw. I understand his new projection is only for a width of 40 degrees in longitude. If you extended it beyond 40 degrees in longitude, will the errors show less favourably in comparison with the polyconic?

Mr. MCCAW: I am sorry that I forgot to answer one of Sir Sidney Burrard's first questions, of which the present question is really an extension. Perhaps the best answer is this: The tables of the common rectangular polyconic which we use at present, computed by Major L. Darwin, R.E., cover 20° or 30° of longitude. With the new tables it will be possible to extend the longitude

to some figure approaching 40° without increasing the average error. The errors of all polyconics increase with the square of the longitude from the central meridian. By securing approximate orthomorphism, however, we get nearly rid of the error of bearing round a point, and we obtain the further advantage of being able to employ a scale factor, thus reducing scale error. Since the errors in the common rectangular polyconic are both positive and negative, the application of a scale factor would introduce no improvement.

The PRESIDENT: I am afraid I cannot pretend to have understood every single word uttered this evening. There have been some very ugly words uttered by Mr. Hinks; but I dare say he viewed them with repugnance. We all of us grasped Sir Charles Close's idea, and also have realized the practical value of it if it could be translated into effect, and we all wish to thank these gentlemen for having brought forward this subject of projections.

MOUNT EVEREST EXPEDITION

WHEN the President announced on January 10 that permission had been received for the Expedition to enter Tibet this year, he said further that the passes would be open about the end of May; and it was afterwards planned that the Expedition should assemble at Darjeeling towards the middle of May with the intention of moving on the 14th, or some day closely following, according as the news might be good or bad of the condition of the Jelep La, the pass leading into the Chumbi Valley. There had been some fear that delay in the passage of the ships carrying one or two members of the Expedition might interfere with the punctual start. It is, however, satisfactory to learn from a Reuter's telegram that the main expedition was to leave Darjeeling on May 18 and 19, within four days of the earliest possible. The surveyors had left a few days before with the intention of proceeding by the Tista Valley, and were to join the main party at Kampa Dzong.

The Surveyor-General of India is very anxious to make a strong connection between the triangulation of India and the surveys to be executed north of the range on the upper waters of the Arun and on Tingri Maidan. It would seem that the Tista Valley provides a straighter connection for this triangulation, as indeed it would have provided a shorter route for the whole expedition. But the road in the Tista Valley is so bad that it was judged preferable to take the main party a longer as well as a much healthier way round.

The Expedition this year has always been spoken of as a reconnaissance, and it is important to make clear at the start that it is hardly expected that the climbers will reach the summit, or any extreme height on the mountain in the present season. The instructions to the Chief of the Expedition, after laying down that the aim of the expedition is the attainment of the summit of Mount Everest, and that all activities should be made subordinate to that supreme object, proceed as follows: "For the

present year the main object is reconnaissance. This does not debar the mountain party from climbing as high as possible on a favourable route, but attempts on a particular route must not be prolonged to hinder the completion of the reconnaissance." In other words the climbers will go as high as they can provided that they are thoroughly satisfied they are on the best route to the summit, but it is essential that by the end of the present season there should be no doubt which is the best route. When one considers that the surroundings of the mountain are completely unknown, it is pretty clear that the complete reconnaissance is likely to occupy very fully the whole of the present season, and that only exceptional good fortune, and rather easier conditions than are probable, can allow the leader of the mountain party to rest satisfied that of any possible routes he had chosen best, and still to allow time for a serious attempt to reach the summit this year.

There is, however, excellent ground for hoping that at least two new records may be established. The highest camp yet made is Mr. Meade's on the saddle of Kamet, about 23,500. The highest point reached by any climber is about 24,600 by the Duke of Abruzzi and his guides on Bride Peak. It would not be over-sanguine to think that in the course of this year the Mount Everest Expedition will have a camp higher than Mr. Meade's, and have reached a point higher than 24,600. For no expedition has ever before worked in conditions that promise so well, or with a party so thoroughly organized.

In view of the desire of all members of the Society and of the Alpine Club to receive the earliest possible and fullest information during the recess, when there will be no meeting at which announcements can be made, the Committee have arranged that long cablegrams and news letters shall be dispatched as occasion allows every week or ten days for publication in the *Times*. These cablegrams are the copyright of the Mount Everest Committee, but may be copied twenty-four hours after publication with the usual acknowledgments. It is hoped also that a considerable number of photographs will be received by mail from the expedition, and a selection of these will be made available for the illustrated papers. All the photographs as they arrive will be shown in the photograph room of the Society; and in the map room a map will be displayed showing as far as possible the progress of the expedition. The topography of the whole region being almost unknown, there is likely to be considerable doubt at first in the interpretation of cablegrams, but it is hoped that in the course of the summer preliminary copies of the maps of the survey party will be received, and these will be shown as they arrive.

REVIEWS

EUROPE

Coal in Great Britain.— Walcot Gibson, D.Sc. London: Edward Arnold. 1920. Pp. 311. *Maps and Illustrations.* 21*s. net.*

Coal.— J. H. Ronaldson. London: John Murray. 1920. Pp. 166. *Maps and Diagrams.* 6*s. net.*

THE first of these volumes is a general text-book on the origin and nature of coal, with special reference to its occurrence in Great Britain. It is an excellent book, clearly written, well illustrated, and supplied with an exhaustive index, but it has no references to larger and more specialized works. Dr. Walcot can be congratulated on having written a useful volume which should make a wide appeal to mining students and engineers.

The small volume by Mr. J. H. Ronaldson is one of the Imperial Institute Monographs on Mineral Resources. It is encyclopædic in its brevity and the number of facts and figures which it cites, but that is in keeping with its object as a work of reference. The monograph covers the coal deposits of the whole British Empire. A useful bibliography is added.

The Making of Europe.— W. H. Barker and William Rees. London: A. & C. Black. 1920. Pp. viii. + 298. 6*s.*

This book may be emphatically and unreservedly recommended, not only to teachers of geography and of history, but to all and sundry—not excluding, in the Scotticism, the sapient scribes who daily in the penny papers instruct us on the political and economic problems and personalities of Europe; for it presents a geographical treatment of the historical development of Europe from the invasion of the Huns to the present day. The book is equally satisfactory in matter, method, and make-up; indeed, for its price it is a better turned-out book than anything of its kind that we have seen for many months. The selection of material is at once useful and catholic, and its presentation is quite admirable. There is no affectation of omniscience, no splitting of straws, no forcing of points. Many interesting minor influences are ignored, for the aim of the book—quite rightly—is to give broad outlines and a wide outlook; but essentials are never ignored, and are presented convincingly.

The book is really, though not in actual arrangement, divided into three parts, dealing respectively with: I. Early and Mediæval Europe; II. Modern Europe from 1789 to 1878; and III. Economic Europe from 1878 to 1920. The parts are approximately equal in size, but cover, of course, respectively *c.* 1400, 100, and 40 years. The rapid sketching of the first part is, however, entirely satisfactory, providing every vital foundation for the full discussion given to the French Revolution and its sequels. In each part the widest interpretation is given to the word "Europe," *e.g.* two chapters in Part III. deal with "World Problems" generally and "The Middle East" particularly; and everywhere there is the most careful co-ordination of the geography and the history, illustrated by black-and-white maps and diagrams of the greatest value —clear, ingenious, and suggestive.

Each chapter ends with a Recapitulation and a set of Questions; and the latter cannot be answered by merely looking up a certain section of a certain page, but are a real test of the meaning rather than the mere statements of the chapter.

It is a pity to use *watershed* nowadays in the sense of *water-parting* even if originally derived from the same root as *scheiden* "to part."

L. W. L.

ASIA

Review of the Civil Administration of Mesopotamia.— Miss Gertrude L. Bell, C.B.E. London: H.M. Stationery Office. 1920. Pp. 149. *2s. net.*

Perhaps Blue Books and White Papers have acquired their reputation for dryness unjustly; but it is a commonly accepted belief that the information they contain, though undeniably valuable, is so unattractively presented as to preclude any ordinary man or woman from digesting it. In this White Paper (a substantial volume) by Miss Gertrude Bell, whose name, by virtue of her travels, is well known to all students of Middle Eastern affairs, we have a striking departure from the old traditions. Nor is her book less remarkable for the matter it contains than for the manner in which this is treated. When news was received last summer of "regrettable incidents" in Mesopotamia and a general state of chaos throughout the country, the British public became concerned as to the Government's policy, and correspondence in the Press revealed a rather remarkable ignorance of British activities apart from military operations. It is with the civil administration that Miss Bell deals, and although the period under review includes the years during which Mesopotamia was an important theatre of war, she keeps military history very properly, and very skilfully, in the background.

In any opinion on the efficiency of British administration in Mesopotamia comparisons must inevitably be drawn between the new order and the Turkish *régime*, especially as it was considered advisable, in the initial stages of our occupation, not to destroy the old system root and branch, but rather to cut out the tangle of weeds and ingraft reforms gradually. As we read this Review and observe these reforms in process of growth, it becomes abundantly clear that the most formidable difficulty with which our administrators were faced was the cumbrous inefficiency of the old system of "government by sedentary officials according to minute regulations framed at Constantinople for Western Turkey." We learn on the first page: "It is not too much to say that the Mesopotamian Wilayats of Basrah, Baghdad and Mosul had reached the limits of disorder consonant with the existence, even in name, of settled administration." And again: "Instead of utilizing the power of the shaikhs the Turks pursued their classic policy of attempting to improve their own position by the destruction of such native elements of order as were in existence. . . . To recognize local domination and yoke it to his service lay beyond the conception of the Turk, and the best that can be said for his uneasy seat upon the whirlwind is that he managed to retain it." Such was the status of authority in the country in which, side by side with the conduct of military operations on a large scale, we had to organize and set in motion a system of administration: a task the difficulty of which is only equalled by the extraordinary interest of this story of its fulfilment.

In the second chapter of the book a clear idea is given of the framework of British reform, to which the details were added later, and in the three succeeding chapters we watch the gradual application, and the working, of our adminstrative measures in the ever-increasing area under our occupation. It is these chapters that Miss Bell, with unobtrusive art, interweaves with brightly coloured threads of local history and ethnology, of which she speaks with an authority probably unequalled. By the exercise of a humour, and a gift for anecdote, as refreshing as they are unexpected in a White Paper, personalities, situations, and the mentality and mode of life of the tribesmen are portrayed with a skill which is remarkable. As an instance may be cited the passages dealing with the Holy Cities of Karbela and Najaf, where the perplexing inter-

play of politics, religion, and fanaticism, together with the feverish mentality of some of the prominent inhabitants, are vividly depicted.

The seventh and two succeeding chapters of the Review comprise an account, prolific in facts and figures, of the Revenue, Judicial, and Financial Administrations, with their subordinate departments. The last chapter will prove of supreme interest to many readers, for it gives a full account of the Nationalist movement in Mesopotamia and of the causes of the serious trouble of last year. The summary of political conditions at the end of the war and the explanation of the gradual change of sentiment in the country, together with some revelations as to the men behind the scenes, will throw a new light on a situation which has suffered from considerable obscurity; and grave as the disorders were, Miss Bell's account will do much to counteract the depressing conclusions which they suggested at the time. That alone would be a result worth attaining: but the book will also perform an invaluable service in putting on record the work accomplished by the British Administration in Mesopotamia during the last six years. Miss Bell is to be congratulated on her fascinating report. H. B. R.

Through Central Borneo: An Account of Two Years' Travel in the Land of the Head-Hunters between the Years 1913 and 1917.— Carl Lumholtz. 2 vols. New York: Charles Scribner's Sons. 1920. *Map and Illustrations. Price 42s. net.*

The author of these volumes is well known as a zoologist and chiefly an anthropologist, from his travels and investigations in Mexico during several years and earlier in Queensland. In 1913 he projected an exploring expedition to New Guinea, "the promised land of all who are fond of Nature and ambitious to discover fresh secrets." It was "a Norwegian undertaking," but it was assisted by grants from, among other bodies, the Royal Geographical Society. Intending to employ Dyaks as his carriers and helpers, he proceeded first of all to Borneo to engage them. The outbreak of the Great War, however, necessitated the abandonment of his plans, as it frustrated so many another project. Till the return of better days Mr. Lumholtz decided to turn his attention to an exploration of Central Borneo, "large tracts of which are unknown to the outside world." The ethnology rather than the geography of the country appears from his narrative to have specially claimed his observation.

Borneo, which contests with New Guinea the distinction of being the largest island of the Globe (apart from Australia and Greenland), is heavily forest clad, and drained by large rivers rising in the central highlands, some of them deep enough to be navigated by steam launches of considerable size for some 300 or 400 miles. The island possesses a humid climate and a temperature rarely oppressive. The author's experiences led him to consider Borneo to be "quite pleasant and probably less unhealthful than most equatorial regions, particularly in the central part where malaria is rare and prickly heat does not occur." The country is rich in valuable timbers, and excellent wild fruits; it possesses a vast and magnificent flora, and its only very partially discovered zoological treasures are remarkable for number and peculiarity. Mr. Lumholtz believes that the Chinese were the first to make discovery of the island, but that it received its earliest colonists from the Hindu kingdom of Madjopahit in Java. These introduced Hinduism, tinged with Buddhism, and that in turn had to give way to Islamism, now the widely recognized religion among those who inhabit at least the sea borders of the country and river-banks in touch with the outer world. The autochthonous inhabitants of the interior remain pagans.

Magellan's expedition in 1522, by which the island was spoken of as 'Bornei,' brought to Europe its earliest knowledge of this splendid province of the world. By 1906 the whole of Borneo had been finally portioned out between the Netherlands, Sarawak, and the British North Borneo Company.

Starting out from Bandjermassin, the capital, the author's first journey took him along the east coast to the Kayan river, which he ascended as far as Kaburau—where he hoped to engage the Dyaks he wished for his New Guinea expedition—gaining his first experience of the "kihams," or violent rapids, so characteristic of the Bornean rivers, by which his boat-navigation was so often rendered difficult and dangerous. Failing in his quest, he returned to Bandjermassin and eventually to Batavia to complete his arrangements for his New Guinea trip. There it was that he was overtaken by the war-wave and compelled to forgo his project. Being on the spot, as it were, he determined to seize the opportunity to visit Central Borneo. Towards these regions he chose as his highway the Barito, the great river flowing south from the interior into the sea at Bandjermassin. This he traversed north as far as Puruk Tjahu in nearly half a degree of S. latitude, a distance to which it is more or less navigable by small steamers. Returning thence with his collections, he made a second ascent of the Barito to beyond this point. The expedition, passing the equator at Bahandang, traversed "vast jungles" and a series of great rapids—twelve in number—and eventually reached the narrow divide, 1400 feet high, which separates the Barito from the Mahakam. Crossing this, our traveller reached a short cataract-interrupted tributary of the latter river which led him into the main stream, there even in its upper reaches 50 to 60 yards wide. Four and a half months' canoeing brought the expedition safely to Samarinda at its embouchure. Thereafter an excursion to the north-east of Bandjermassin and finally one up the Katingan river to the west of the capital completed Mr. Lumholtz's Bornean adventures. As already remarked, his observations are mainly devoted to the anthropology and ethnography of the tribes visited, of whom he made acquaintance with a large number, including Kayans, Kenyahs, Murings, Penyabongs, Saputans, the nomadic Punans and Bukits, Penihings, Oma-Sulings, Long-Glats, Katingans, Duhoi (Ot-danums), and the Tamoans—none of whom, to his regret, was he able thoroughly to investigate. The observations he was able to make are none the less of very great value. A detailed report, however, is promised later on the observations made during these long and arduous journeys, and on the extensive ethnographical material collected, especially as regards decorative art and the protective wooden carvings called kapatongs—representations of good spirits (antoh) or of objects which good spirits have entered, which are always of great importance in the religious life of these tribes. The varied riverine landscapes, with their villages and inhabitants, are described in a very pleasant manner. Throughout these volumes are scattered many medical hints which will be of value to intending tropical travellers. 'Through Central Borneo' is illustrated by numerous photographs of special excellence by the author, while a sufficient map, with Mr. Lumholtz's route in red, and a good index are provided. H. O. F.

AFRICA

The Siwi Language.— W. Seymour Walker. London: Kegan Paul, Trench, Trübner & Co. 1921. 10*s.* 6*d.*

The oasis of Siwa is situated in the Libyan Desert, about 350 miles west-south-west of Cairo. It is one of the relics of a region, well watered and forested in prehistoric times, which extended west of the Nile basin (receiving

overflows of the ancient Nile) from the Cyrenaican coast to the confines of Darfur, by way of the little-known district of Kufra. Siwa was known to the ancient Egyptians as "palm land," and three or four thousand years ago the area of its plantations of date-palms was probably five times larger than to-day. It became the resort at a relatively remote period of a section of the Libyan peoples akin to the Libyans or Berbers of North Africa, and more remotely allied to the Cushitic race of North-East Africa. About a hundred years ago it was known that the Siwa ("Siwi") language was closely akin to the Berber languages or dialects of Tripoli, Tunis, Algeria, Morocco, and the Sahara desert. But until the publication of this interesting little book no full account of the Siwi speech had been given—nothing approaching a grammatical sketch, merely a few words, short vocabularies which were sufficient to establish its relationships.

It is a great pity that in preparing this work for publication the author did not make himself acquainted with the phonetic systems in vogue for transliterating unwritten tongues; even, let us say, the system long in use by the Royal Geographical Society. This may not be sufficiently elaborated for minute distinctions in sounds, but it is intelligible to those who require an approximately accurate appreciation of the main features of a language. As it is, the author seems to have gone back to the very early nineteenth century or the eighteenth for his system of transliteration. We are up against the *aa*'s, *ee*'s, *oo*'s of long ago for simple vowels like *ā*, *ī*, *ū*. The single symbol *ī* is made to stand for the diphthong *ai*. Moreover, in describing the short sound of *a* the author repeats a common mistake. This in Semitic and Libyan tongues is *not* equivalent to the English *a* as in "cat" (*æ*). It is really reproduced by the sound of *u* in "cut," "hut." The sounds *ea* (as in "pear") and *æ* (as in "bad") *do* exist in some Arabic dialects (such as Maghribi) and in Berber or Libyan, but in the Arabic they are a development of the stressed *ā*. In illustrating the stressed *ō* in Siwi (= *o* in "store") the author selects unfortunate Italian examples in which the *o* is really equivalent to the *o* in "bone." The *ō* sound is common enough in Italian (as in "hó" = "I have," "buono," "good"), but is not thus pronounced in "como," "maestro," or "cielo."

The *gh* which causes the author some perturbation is simply the Arabic ġ, a velar pronunciation of *g*, exceedingly common in African, Libyan, and Semitic tongues. It is the lower equivalent to χ, which is a guttural-aspirate relative of *k*. For a variety of reasons the best transliteration of this "gh" is the Greek gamma (γ).

There is so much philological interest in this book that it is almost a pity another edition could not be printed with Siwi rendered by reasonable phonetic spelling. H. H. JOHNSTON.

AMERICA

Through British Guiana to the Summit of Roraima.— Mrs. Cecil Clementi, M.B.E. *With 14 Illustrations and Map.* London: T. Fisher Unwin. [1920.]

Almost at the moment when Mrs. Clementi's book was published, the man who had the good luck in December 1884 to find the way up Roraima, till then deemed inaccessible, received a letter from America, the writer of which expressed his surprise, seemingly not untinged with regret, at the discovery recently made by him that Roraima had been ascended. He is a writer of popular books, and had been collecting material from which to write of that

unknown tableland from which, as he now discovered, the romance had been broken, like a soap-bubble, thirty-six years ago.

The American correspondent was answered that Mrs. Clementi's expected book would probably tell the story of Roraima. That, perhaps rather unreasonable, hope has not been altogether fulfilled ; and there is still room for a book in which should be brought together all that is known of that remarkable sandstone rock from the day when it was first seen by Schomburgk (the story of Sir Walter Raleigh having from a distance set eyes on it is a vain imagination) to the recent day when Mrs. Clementi, the first woman to do so, set foot on its top.

Mrs. Clementi has not added much to our knowledge of Roraima, but she has given us a very readable account of a walk through a part of the savannahs of British Guiana which, as far as is known, had never been trodden by European feet, unless indeed, centuries ago, some Dutch trader from the Essequibo or some Roman Catholic priest or Spanish trader from the Orinoco may possibly have made an unrecorded excursion into those parts.

To geographers, and to Government officials and others interested in the long overdue development of the interior of the British share of Guiana, the chief interest of the book lies in the many hints it gives as to possible ways of facilitating the entry of would-be visitors into that land of old romance and of wonderful natural scenery—thus incidentally paving the way for the development of the real riches of the country.

Perhaps the most valuable part of the book is the sketch-map, from a prismatic compass traverse by the author's husband, of the narrow belt of hitherto unexplored country through which the expedition passed ; and attention should also be called, in connection with this sketch-map, to the very illuminating diagram which is also given of the "section of country traversed between Kaietuk fall, on the Potaro river, and Mount Roraima."

It is a point of no great importance, but perhaps a mild protest may be made against the attempt made by both Mr. and Mrs. Clementi to substitute the name Kaietuk for the old-established name Kaieteur. This was an old fad of the well-known Guiana bushman the late Michael McTurk. Possibly, nay probably, the -uk termination is strictly speaking right, but the other and better known -eur will, it may be hoped, be retained. E. IM T.

Spanish America: its Romance, Reality, and Future.— C. R. Enock. 2 vols. London: Fisher Unwin. 1920. 30*s*.

South America, Past and Present.— L. C. Bollo. New York. 1919. (Translated from Spanish by N. Baros.)

The States of South America.— C. Domville-Fife. London: Bell. 1920. 15*s*.

South America and its constituent states, being of rather special interest from the point of view of modern external commercial development no less than of history, are the subjects of a large collection of descriptive works. In some—a limited number—of these geography is given its proper status ; in many it is emphatically not. But in the three works under notice, very different as they are in style, arrangement, outlook, and object, our science is not neglected, and its adaptability is very clearly illustrated.

Mr. Enock needs no introduction as a geographer. His book is intended to be "in a measure auxiliary" to those of the well-known *South American Series*, and it incorporates a number of descriptive passages from their pages. It is adequately illustrated, and its discursive interests—for it is not arranged

on severely methodical lines—fit it for the casual reader, while on the other hand no serious student of South American geography can afford to neglect Mr. Enock's work. In this book we visit with the writer first Central America, then Mexico; thence return on our tracks and proceed along the Pacific coast of the Andes; next we are in "the lands of the Spanish main," the Amazon valley, Brazil, and the lands of the Plate. We are informed now geographically, now historically, now on ethnology, economics, and the rest, and we can classify our information, if we will, with the help of an index in each volume.

Mr. Bollo limits himself to a small compass of pages. Being so limited, after an historical review, he views the continent regionally: in fact, the book is an interesting example of the regional as distinct from the political treatment, but by no means ignoring the latter, which has a chapter to itself. This is more essentially a geographical treatise than either of the others under review; it has some maps of the inartistic but informative character familiar in American publications, and it is adequately translated, but, alas! it has no index, a sad defect in a book so arranged.

In Mr. Domville-Fife's volume, which is really a complete revision of an earlier work, we find a severely practical treatment, avowedly from the commercial standpoint: of any regional survey of the continent as a whole, of any details of history, of any picturesque human touches, nothing. Nevertheless the book so far as it goes is more readily informative than the others; for any one who needs the hard facts applicable, let us say, to his business in any of the South American States this book is excellent alike in arrangement and in matter, and as it opens on each country with a notice of its topography and correlates its development with that, it forms a valuable and methodical work of reference on the several independent political divisions of South America—not, it may be observed, the colonies. It has maps and photographs.

O. J. R. H.

AUSTRALASIA AND PACIFIC ISLANDS

Stevenson's Germany: The case against Germany in the Pacific.— E. Brunsden Fletcher, Author of 'The New Pacific' and 'The Problems of the Pacific.' London: William Heinemann. 1920. *Price* 12*s. net.*

In so many books Robert Louis Stevenson has been shown as the central figure in the picture, with the South seas and islands as a mere background, that the main title of this the third book in which Mr. Fletcher, from the Australasian point of view, tells the history of the Pacific as a European resort, may deter the reader in quest especially of geographical information from a really interesting volume; and even the second title hardly suggests its real value, which lies in the fact that in it the writer has given not only a summary of R. L. S.'s prophetic but at the time unheeded warnings as to Germany's schemes, but, as *parergon*, has supplied clues to much that it is difficult to find elsewhere as to Germany's special methods of penetration into the Pacific. Certain sentences in the author's rather exclamatory indictment suggest at first sight that in his opinion German action in the Pacific was as atrocious as in Africa; but elsewhere he does the Germans the justice to admit that in the Pacific their conduct was nowhere as bloodthirsty as it was in Africa, for instance among the Hereros. But he holds that their Machiavellian policy of pushing in by means of trade after Englishmen and Frenchmen had done the preliminary spade-work of exploration and partial civilization, as also their treatment, by compulsory methods, of the native coloured labour, was as bad in the one place as in the other. Incidentally, however, and herein seems to lie the chief and not inconsiderable

value of his book, he indicates the sources, most of these not very well known and not easily accessible, from which he has derived the story of the establishment in 1885 of the great Hamburg trading firm of Godefroy in the Pacific, and the subsequent conversion of this firm into an Imperial affair, which was the main instrument by which "Germany in the Pacific" was created.

The more important, because least accessible, sources which Mr. Fletcher quotes in support of his "political geography" are Australasian bluebooks and Government reports in which the whole history of "the German firm" is to be discerned, somewhat obscurely it must be confessed. These prints are mainly founded on the evidence of Sterndale, Louis Becke, Trood, this last-named afterwards British Consul in Samoa, all of whom had been more or less in the service of the Godefroys—though Mr. Fletcher is probably justified in treating them as honest witnesses. Our author also refers, possibly with equally justifiable reliance, to MS. annotations, by these same witnesses, on the books in the Mitchell Library in Sydney, that most useful institution in which practically the whole literature of Australasia is shelved. E. IM T.

POLAR REGIONS

The Lands of Silence: A History of Arctic and Antarctic Exploration.— Sir Clements R. Markham. Pp. 540. Cambridge University Press. 1921. *Maps and Illustrations.* 45*s. net.*

Sir Clements Markham's earlier history of Arctic exploration, 'The Threshold of the Unknown Region,' first published in 1873, went through several editions, and is still deservedly considered as the standard English work on the Arctic. The present volume is much larger and includes both Arctic and Antarctic travels down to 1913, to the south being allocated about one-quarter of the book. It was written apparently in the years immediately preceding the author's death in 1916; and fortunately was in such an advanced state by then that very little has been needed to make the book complete. From the spirited style of parts of the Arctic narrative, however, one suspects that the account of events in the middle of the nineteenth century must have been written somewhat earlier, when the author was still in his prime.

The section dealing with the Antarctic is the less satisfactory of the two. Of 120 pages no less than 50 are devoted to Capt. Scott's expeditions. Other important explorers are treated much too briefly, particularly Wilkes, D'Urville, Bruce, and Shackleton. In the case of the two latter explorers, and indeed in the matter of all recent Antarctic work, it is clear that during the last fifteen years of his life, during which the opening up of Antarctica took place, Sir Clements was no longer prepared to appreciate what was being done, except in so far as it was the work of men with whom he was personally acquainted. As a whole, therefore, this account of Antarctic exploration cannot compare with Dr. Mill's 'Siege of the South Pole.' If disappointed, however, in not finding this a comprehensive or authoritative account of Antarctic work, readers of the book will nevertheless fully appreciate the story of Captain Scott's expeditions, so sympathetically set down here by his friend, and will read with interest of the part which the author himself played in the equipment and relief of the *Discovery*, or as he prefers to call it the Societies' Expedition. The personal nature of the book is further emphasized by the fact that the only Antarctic ship illustrated is the *Morning*, bought and despatched on behalf of the Societies by the author to relieve Scott in 1903.

Comparing the Arctic narrative with the much shorter Antarctic one, it is clear that the former is the author's real field. Sir Clements visited Baffin

Bay and Lancaster Sound in 1850–51 as a midshipman on board the *Assistance*, one of Captain Austen's searching squadron. He came back with an enthusiasm for the polar regions, which was to last over half a century, and whose effect in furthering polar exploration has been incalculable. In polar matters he soon came to occupy a position comparable only to that held by Sir John Barrow in the first half of the century. It is impossible, therefore, not to compare the two: both while still young wrote histories of Arctic travel expressly to stimulate public interest, Barrow in 1818, Markham in 1873; and both in later life were able to write a second volume embodying the results of the Arctic explorations which they themselves by work at home had so largely helped to success. Barrow's vigorous attack on Sir John Ross is still remembered; Sir Clements in the present book is just as outspoken in his likes and dislikes, and never leaves any doubt as to who is to have the praise and who the blame. This feature, together with numerous personal notes on the later careers of naval "Arctics," gives the book its character and interest. At the same time it must be admitted that it is not so much an impartial history of Arctic exploration, as the impressions and judgments of one who knew most of the leading actors personally.

The early chapters were necessary for completeness, but compared with what follows they seem to lack life. With each succeeding chapter, however, the author's interest increases, culminating in the nineteenth century. The chapters dealing with the period from Ross's voyage in 1818 down to Nares' in 1875–76 are without doubt the most interesting of the whole book. They deal with the people whom the author actually knew.

A few of Sir Clements' opinions may be quoted. Baffin and Davis are undoubtedly his favourites among the earlier voyagers: Bylot, however, he can never excuse for deserting Hudson. Belcher is condemned in the strongest terms: on the other hand, Sir John Ross is exonerated. As to the North Pole controversy: Sir Clements seems to think that Dr. Cook's was a much finer journey than is generally believed, and that Peary no less than Cook was in error in believing that he had actually reached the Pole.

The illustrations are not very well selected. This may perhaps be set right in a later edition; and certainly an entirely new set of maps will have to be provided. Ravenstein's excellent maps were a feature of 'The Threshold of the Unknown Region.' In the present volume the map given of the Arctic has been out of date several years; there is no map of the Antarctic; and no satisfactory map of Arctic Canada to illustrate the Franklin search. The poorness of the maps is a distinct blemish on the most interesting account of Arctic exploration written in our time. J. M. W.

THE MONTHLY RECORD

EUROPE

Distribution of Population in Sicily.

A CAREFUL study of the distribution of population in Sicily, on the lines of one previously undertaken by Dainelli for Tuscany, has been brought out by Prof. A. Mori as No. 36 of the *Memorie Geografiche* issued as a supplement to the *Rivista Geografica Italiana* (Florence, 1920). The social and economic problems connected with such a study are unusually important in the case of Sicily, owing to the extraordinary variations of density from one part of the

island to another, and it is particularly interesting therefore to correlate such variations with the topography and other geographical factors. Prof. Mori considers the subject from diverse points of view, and the labour involved in the collection of the data, and their handling so as to bring out the lessons to be learnt in the most instructive way must have been very great. The text describes the methods employed, and discusses in detail the facts of the distribution, paying attention not only to present-day conditions, but to historic changes; while a series of maps on the uniform scale of 1 : 800,000 supplies an excellent graphic representation of the facts. The first of these has been compiled, in the usual way, on the basis of communes as units, but in view of the very varying size of these the result is not altogether satisfying. Prof. Mori has therefore constructed a second, in which curves of equal density are drawn according to a method used some years ago by O. Marinelli. Both maps bring out the fact that the greatest density occurs in the environs of Palermo, the eastern slopes and coastal zone of Etna, and the extreme north-east, but it is only the second which shows the density on the slopes of Etna as decreasing from the coast upwards, this being masked in the other by the fact that some of the communes run upwards to the summit. The density of the whole island is 144 per square kilometre—greater than that of Italy as a whole—but there are considerable stretches of the coast with an average density of over 500. The difference between individual communes is very great, owing to the great differences in area, and according to the presence or absence of urban centres. One of the most marked characteristics of Sicily is the concentration of population into such urban centres, and the extreme sparsity of the population of wide intervening tracts. In order the better to bring out the distribution of the scattered population, one of the maps shows this alone by gradation of shading, while the position and size of the centres of habitation are shown by a series of symbols. In the whole province of Girgenti the scattered population amounts to only 4 per cent. of the total. Prof. Mori gives particular attention to the altimetric distribution, and also to the effect of the distance from the sea. In the north and east the density decreases in general with altitude and distance; but on the south-western versant the population tends to be aggregated at some distance inland. As has been observed elsewhere, there is often a certain diminution with altitude, followed by a distinct increase again at higher levels. The population of the island has fluctuated enormously within historic times. From a possible four millions in early Greek times it fell to perhaps little more than half a million at the beginning of the sixteenth century, since which it has gradually recovered to its present total of something like four millions. Associated with this fluctuation is the large number of centres—157 out of a total of 361 communes—which have come into being only within the last four centuries. This is the subject of a supplementary article by Prof. Mori in the *Rivista Geogr. Italiana*, Settembre–Dicembre 1920, which shows how the new centres have not been evolved by a natural process, but were founded of set purpose for the colonization of lands that had become derelict.

AFRICA

French Exploration in the Western Sahara.

A long-cherished ambition of the French in the Sahara—to effect a junction between Algeria and Mauretania in the same way in which a junction between Algeria and the Western Sudan was brought about some years ago by Colonel Laperrine and his coadjutors—was successfully realized during December of last year. Early in January came the news from Senegal that two columns, the one

starting from Algeria under Captain Augiéras, the other from Mauretania under Major Lauzanne, had met before the end of the year at a spot arranged in the very centre of the least known part of the Western Sahara, lying south of Marocco and known at first hand only from the journeys of Caillié and Lenz. Captain Augiéras, whose valuable memoir on the Western Sahara was reviewed in the *Journal* for February last, had already done much to improve our knowledge of this region by his network of routes, from 1913 to 1917, to the west and south-west of Twat, so that the route to be followed by his column was to some extent over known ground. His party included three other French officers and 150 "Meharists" (camel-riders). Starting on December 1 from Tab-el-bala in about 29° N. and nearly due south of the Marocco-Algerian frontier, he had to proceed slightly south of south-west to reach the proposed rendezvous of El Mzereb, situated a little north of 24° in about 6° W. of Greenwich. This is one of a series of watering-places which line the course of the Hank, or escarpment by which the broken plateau in the centre of the Western Sahara, already explored by Captain Augiéras, falls north-west to the region of sand-dunes of the Igidi. According to the preliminary accounts of the journey the route seems to have led for the most part across the Igidi, possibly traversing some of the higher ground before reaching the rendezvous. The other column started from Atar in the Western Adrar, and, passing through Rhallawia, proceeded north-east through nearly unknown country, apparently striking the Hank near its south-west end and following it to the north-east with the help of the line of watering-places already mentioned. The two columns met at El Mzereb on Christmas Day, that from Algeria being escorted on the final stage by a party sent to meet it by Major Lauzanne. Both columns were at Atar by January 19, Captain Augiéras then continuing his journey to the south-west through the dune-belt of Waran, the Tagant plateau, and the Brakna plain, reaching Dakar on April 5 and so completing a journey of 4500 kilom. He has since returned to Paris, and fuller accounts of his experiences may therefore be expected shortly. Whilst previous routes across the Western Sahara have crossed it in an approximately north and south direction, the recent traverse has been in a diagonal direction from north-east to south-west, and geographical results of considerable value are said to have been gained. The general direction of the reconnaissances can be followed on the map accompanying Captain Augiéras' former memoir.

AMERICA

Dr. O. Nordenskjöld's Expedition to Patagonia.

Some account was given in the *Journal* for February of this year (p. 149) of the research expedition to the Andean region undertaken by the Swedish explorer, Dr. Otto Nordenskjöld. He had then completed the first part of his programme—reconnaissances in the Andes of Peru—and had gone south to begin work in the mountains of Southern Chile, with a special view to glaciological observations. This part of the enterprise has also been successfully accomplished, and Dr. Nordenskjöld has returned to Europe with a rich harvest of results. We have received through a Fellow of the Society, Mr. Leonard Cooper, M.INST.C.E., cuttings from the Buenos Aires newspapers *La Nacion* and *La Prensa*, giving some details about the expedition which had been communicated by the explorer during his stay at that city whilst on the way home. Dr. Nordenskjöld and his colleagues established themselves at Kelly inlet, on the shores of the Gulf of Penas, in 47° S. lat., and thence made various excursions inland for the study of the glaciers. The cold, constant rain, and absence of inhabitants proved serious obstacles, and Dr. Norden-

skjöld thinks that exploration from the Argentine side of the mountains might offer fewer difficulties. Only at wide intervals were natives met with, probably of Araucanian stock. During the two months' stay, however, a good deal of country was mapped, and besides the glaciological observations studies were made of the flora and fauna, which are likely to yield interesting conclusions.

AUSTRALASIA AND PACIFIC ISLANDS

Flora of the Summit-plateaux of Tasmania.

A further study of vegetation in the Australasian region has been contributed to the *Journal of Ecology* (Vol. 8, 1920, Nos. 1 and 2) by Miss L. S. Gibbs, in a paper entitled 'Notes on the phytogeography and flora of the Mountain Summit-plateaux of Tasmania.' The paper includes detailed descriptions of the collections of plants made by the author, but we are here concerned only with the general discussion of the plant formations and their relations to geological, geographical, and climatic conditions. After separation from Australia in late Quaternary times, Tasmania was subjected to glacial conditions, with little or no vegetation but moss and low shrubs. The country was formerly one huge plateau formed of horizontal lava-flows, the present features being due to subsequent glacial and sub-aerial denudation, which have broken down the greenstone into steps or left portions as isolated groups of high tablelands, the whole distinctly reminiscent of Iceland. The so-called "Central Lake Plateau," with a height of from 2500 to 3300 feet, is flanked by mountain summit-plateaux rising to 5000 feet, while the west coast is composed of pre-Cambrian schists, gneisses, granite, etc., in rugged mountain masses not rising above 4500 feet. This western region has a very heavy rainfall of over 150 inches. Judging by mean temperature only the climate is temperate, but the plant-covering is chiefly affected by the cool summer and constant storms. It is generally uniform, but may be classified as (1) The Austral-montane flora of the summit-plateaux; (2) Mixed forest of the west coast; (3) Eucalyptus formation of Australian type. That this last is comparatively recent is proved by the absence of a single endemic genus, and its exotic character is also shown by the liability of the forests to be killed by severe frost. The first-named formation—the principal subject of the study—is divided by Miss Gibbs into open and forest associations, the former largely consisting of mountain shrubbery, the latter of dwarf or low mountain forest with some small *Eucalyptus* scrub. The herbaceous subdivision of the open associations includes a remarkable form, found on the most exposed levels, described as "plant-mosaic." After the late melting of the snow, a level covering of small moss-like plants is developed, the different shades of foliage blending and contrasting, and strongly suggesting a mosaic pavement. Although moss-like in appearance it is quite hard to walk on. This must have been the chief plant-covering of the ancient plateau, being gradually succeeded by the mountain shrubbery as the rocks became weathered so as to afford root-hold for larger plants. In the shrubberies no one plant predominates, and instead of the wide colour effect of a single species, the various colours—white to yellow and pink—are evenly distributed as over a carpet. The dwarf mountain forest was seen at its best on the summit-plateau of Mount Field, where all the usual species of the mixed forest occurred in much dwarfed form, about 10 feet high.

The flora in question belongs to a group occurring throughout the sub-antarctic zone under special conditions in widely separated localities. Requiring low temperature, intense illumination, and heavy rainfall for their development, the plants are limited to altitudes above tree-level in normally

forest-clad regions, but find the needed conditions at sea-level in the Antarctic. In the absence of an annual leaf-fall there is no progressive improvement in soil conditions, whilst leguminous plants as nitrifying agents are also wanting, so that herbaceous plants are but sparsely represented. The origin of this scattered Austral-montane flora has long been a subject of speculation, but as it is now practically certain that the various land masses have not been united since the Tertiary period, the wild west winds, the potency of whose agency was long ago recognized by Hooker, must be regarded as the one effective means of transport from one locality to another within the zone in question, while the persistent pole-ward upper current, which blows steadily from north-west to south-east from India over New Guinea and Australia to New Zealand and beyond, may equally account for the distinct Himalayan and Papuan elements in the Austral-Antarctic flora.

Rennell Island.

Probably the least-visited island in the whole Pacific is that known as Rennell, which, with the smaller island of Bellona to the west, lies some 120 miles south of Guadalcanar in the Solomon group. Although almost on the track of steamers, they have remained in virtual isolation on account of the absence of good anchorage, as also of any product of commercial value. Rennell is almost entirely surrounded by walls of coral limestone, 300 feet high in places, cutting off the inhabitants, who speak a hitherto unstudied dialect, from easy intercourse with the outside world. We have received an account of the island from Dr. Northcote Deck, a missionary at Aola in Guadalcanar,

Rennell Island.

based upon a series of visits made by him between 1908 and 1911, which for the first time supplies detailed information on the island and its primitive inhabitants. On the first visit a landing was effected in a sheltered bay on the south coast near the western end of the island, although the depth of water near the shore made anchoring impossible, and the interior plateau or basin was reached by climbing up a crevice in the forest-clad coral cliffs. After a tramp through the evergreen forest in torrents of rain, a single native house was reached, and relations established with the natives, who though heavily armed were quite friendly. They brought every available object for sale, to

obtain the much-coveted iron. All were smeared with turmeric, giving them a bright yellow colour, and were tatooed in regular patterns according to rank. Their peculiar pungent odour was very noticeable. One of them came away in the schooner, but became at once so strongly affected with nostalgia as to be a constant anxiety until taken back five months later. On this second occasion anchorage was found in a deep bay on the south shore, further east than the first landing-place, at a spot known as Kungava, where natives were once more met with. A visit to the interior was again made, by climbing the coral rampart. The track led gently downhill, bearing out the theory that the whole island had once been a gigantic atoll like Leuanina, or even consisted of a wide encircling reef like the Indispensable, 50 miles to the south. The coral was fissured in all directions, the interstices partly filled with red soil, said to be of volcanic origin. Caves were seen, swarming with flying foxes, whose teeth seem to form the only currency on the island. Ten miles of winding track brought the party to the shores of a fine inland lake, 10 miles long, with islands dotted over its western end. It is entirely separated from the sea on all sides, but must communicate by fissures in the coral, as its water was too salt to be drinkable by the visitors (though used for drinking by the natives), and it was subject to a tide of a few inches, once in the day only. The lake is navigated by means of great unwieldy canoes provided with masts and resembling floating platforms. In one of these a native village was reached, where the party again met with an eager welcome. Here they encountered the most important chief of the whole island, who arrived with a small fleet of canoes from the largest village, Vinegau. He was a dignified, powerfully built man, 6 feet high and broad in proportion. His village was visited on a subsequent occasion, and the lake crossed to the north side, where the neck of land was barely 2 miles wide. An attempt to sound the lake gave a depth of 7 fathoms near the western end, but elsewhere no bottom was found with 30 fathoms of line, and Dr. Deck regards it as the crater of a volcanic peak round which the island has been formed.

The population of Rennell is put down as not exceeding 500, the largest village consisting of only eight houses. The people usually live very much scattered, for though 100 congregated at the shore at the first landing-place only a solitary house was seen in that part of the island. Few have ever left for the Queensland plantations, and none who went ever returned, so no English is spoken. The climate is evidently mild, for none of the houses had walls to keep out the weather, though the rainfall seems to be heavy. Few groves of coco-nuts were seen, and the gardens were small and poor: apparently the bush has to be cleared solely by burning. The people still possess little iron, and appear in fact to be still living before the Stone age, the only implements or weapons of stone seen being two stone maces, symmetrically ground with eight knobs, bound to a handle with sennit, and seemingly for ceremonial use (one of these is now in the British Museum). There is a similar absence of stone implements in the Solomons, but this is explained by the time which has elapsed since the natives first obtained iron. In Rennell practically no stone but the coral exists, only one black boulder having been seen on the whole island. The islanders are true Polynesians in being great fighters and wrestlers, evidently (unlike the Melanesians) loving personal combat. The men have very powerful frames, though as a rule of no great height; in wrestling they could always throw any of the Malaita men. Their most striking weapons are thrusting spears of hard black wood, about 12 feet long and six pounds in weight, with fifteen to twenty barbs on each side, cut out of the solid.

The making of them would seem to be a lost art. Throwing spears are also used, with points made of human leg and arm bones, and tipped with a bone splinter designed to break off in the wound. Bows and bone-tipped arrows were in abundance, whereas the usual Polynesians disdain shooting from a distance. Although mostly friendly, the people are great thieves and murdered three native teachers left with them, apparently for the sake of their goods. They cut out the long bones of the legs and arms, but did not eat the bodies. They seemed to feel keenly the monotony of isolation, and showed a settled melancholy both in their faces and the cadence of their voices. Their only sort of music, to which they dance as it were in monotone, consists in the tuneless beating of a log. It is questionable whether intercourse with the outside world would be a blessing to them. Malaria seems to have been unknown in the past, but in spite of all precautions to have been introduced temporarily by a party of five that had been taken to Malaita. No species of anopheline mosquito could however be found.

Bligh's Journal of his Second Voyage.

In the review, in the April number (p. 303), of Mrs. Marriott's recent book on the above voyage, it is stated, as it is also in the book itself, that Bligh's Journal is preserved at the Admiralty. This was the fact at the time when the book was written, but Mr. R. L. Atkinson of the Public Record Office writes to point out that it is so no longer, since Bligh's Journals have since been transferred to their proper place in the Record Office, where they now form vols. 151 to 153 in 'Ships' Logs, Series II.' For some reason or other the log in question was retained at the Admiralty when others of that date were transferred, according to the usual practice, to the Record Office. In 1876 Bligh's logs were lent to the Science Museum at South Kensington for exhibition, and remained there till 1912, when they were temporarily retransferred to the Admiralty after having been brought to the notice of the Admiralty Librarian through Dr. Corney—the writer, as it happens, of the review of Mrs. Marriott's book. It was the publication of this book which once more called attention to them and led to their deposit at the Record Office early in the present year.

OBITUARY

Lieut.-Colonel Sir James Robert Dunlop Smith, K.C.S.I., K.C.V.O., C.I.E.

SIR James Dunlop Smith was suddenly stricken down with tuberculosis last summer, and had immediately to leave his post as Political A.D.C. to the Secretary of State for India in order to undergo special treatment in Scotland. From the first he meant to put up a strong fight for life, and his firm courage sustained him for a while till there seemed a prospect of his recovery. But he took a sudden turn for the worse and died of heart failure on April 24 at the age of sixty-two.

Sir James was no great geographer; he had made no great journey nor carried out any great scientific work. But he was a great Fellow of our Society. He loved his fellow-men. And his long years in India had brought him in contact with many travellers. So he inevitably was drawn to our Society, and his fellowship with it was of the closest and warmest. As member of Council and afterwards as Vice-President he entered whole-heartedly into our affairs, and

with his usual thoroughness was always willing and ready to help wherever his experience could assist us.

It was this same attachment to his fellow-men and his conscientiousness in affairs which had rendered his career in India and at the India Office so successful. Indians and British alike could feel that he started anxious to be on good terms with them and anxious to help them, and that if he did help them he would help them thoroughly. He was dependable, and he was affectionate; and the loss of one with so strong a sense of fellowship our Society has the strongest reason to deplore. F. E. Y.

Captain S. C. Plant.

News has been received from China of the death at sea, in February 1921, of Captain S. C. Plant, whose name has long been a household word to all interested in the opening of the Upper Yangtse to trade and navigation. It is well known what an obstacle to navigation is caused by the gorges and furious rapids which obstruct the river during its passage through the mountainous belt above Ichang, and which long made communication with the upper river possible only by the slow and laborious method of "tracking"—the towing of native vessels from the banks by long strings of men. When, mainly owing to the efforts of the late Mr. Archibald Little, it was at last decided to attempt the passage of the rapids by a steamer, the *Pioneer*, the command was given to Captain Plant, who had previously had special experience of river navigation on the Euphrates. The attempt succeeded, and though for some years the difficulties proved too formidable to permit the opening of regular navigation, the measure of success attained encouraged the expectation—now realized for a good many years—that the formidable barrier would at last yield to further effort. Captain Plant continued to give his services to the cause, year by year adding to his knowledge of the rapids, and in 1913 was appointed by the Chinese Government to the newly created post of River Inspector for the Upper Yangtse.* He was the author of a 'Guide to Shipmasters and Pilots on the Upper Yangtse,' and only this year published at Shanghai a small volume descriptive of the rapids and their navigation, illustrated by a striking series of photographs and pen-and-ink drawings by Mr. I. A. Donnelly ('Glimpses of the Yangtse Gorges.' Shanghai: Kelly & Welsh). At the time of his death he had just started home on leave, succumbing to pneumonia only the day after sailing from Shanghai.

CORRESPONDENCE

International Aeronautical Maps.

IT is only this morning that I have had the opportunity of reading Colonel Lees' interesting lecture on Aeronautical Maps, which I was unfortunately prevented from attending. I am surprised to see that apparently no British Air Officer contributed to the discussion. The subject is of great interest, and I feel that some independent opinion from the aviation point of view should be put forward.

* Captain Plant's services to Yangtse navigation are summarized in an article by Captain P. A. Lapicque in the *Bulletin Econ. de l'Indo-Chine* for 1917 (see *Journal*, vol. 50, p. 459).

Dealing first with the three controversial points enumerated by Colonel Lees:

1. *Mercator's Projection.* I am not a navigator, but I have had a great deal to do with maps and map-reading all my life; I confess that I have a rooted objection to the use of Mercator's Projection for air work. The speed of aircraft is so great and their range of vision so wide that as aerial transport extends its activities over the world, the general map will be far more frequently employed than the local one. Even on this small scale I consider that any distorted representation of the Earth's surface is most undesirable from the aviator's point of view. We must remember that an aerial navigator in the true sense of the term does not exist to-day; no living man has sufficient experience to claim such a qualification. I think I am right in saying that the airmen who demand the Mercator's Projection are all men trained on strictly naval lines. The present system of naval navigation is based on the fact that the sailor cannot see any of the natural features of the Earth; such a system cannot be suited to a pilot who can see literally hundreds of square miles of the Earth's surface at one moment.

No body of expert opinion exists to contradict the naturally conservative ideas of men trained to navigate the sea; the average pilot, no matter how brilliant a flyer he may be, has only the foggiest knowledge of navigation, and can voice no useful opinion.

Colonel Jack says that flying in the Polar Regions is not likely to be very common, and he therefore does not think the extreme distortion in the north any serious disadvantage. Don't be too sure; the Arctic circle offers a most attractive and economical aerial course for lighter than air craft at certain seasons of the year. No, I view with apprehension the apparently hasty decision of the Convention to adopt Mercator's Projection. I am not sufficiently expert to say what system should be used, but no matter how small the scale, no serious distortion of the Earth's surface should be involved.

2. I am on the whole in favour of hill-shading; not because I think the local map should be the complement of the general map, but because the shading method tells a pilot what he wants to know more quickly and more reliably. For plotting out a course before the start, shading seems to have all the advantages of the layer system, except that the line ruled to show the course is a little harder to see. In the air, the following is the class of problem which presents itself to the comparatively small type of heavier than air craft. Let us say that an aeroplane is flying south under the clouds, which are at 3000 feet, with a view to crossing the Pyrenees. As the mountains are approached it becomes obvious that the clouds will be down on all the higher ridges. The pilot now has to make up his mind: (1) how high he has to climb to clear the highest points; (2) at what point of his course he must start climbing through the clouds; and (3) for how long after that point he must fly before coming down out of the clouds. This problem, I think, can be most readily solved on a shaded map marked with the heights not only of the highest points but of the largest projecting spurs, and this, to my mind, applies to general maps as well as the local.

3. The proposal to show railways in red and roads in burnt sienna appears quite sound. I see that Captain Lloyd suggested exaggerating the main features of towns; once more I am all against any form of distortion.

Finally, I trust that a judicious selection will be made of the areas to be produced first. For instance, the provision of maps for these islands would, in my opinion, be waste of time and money at the present juncture; the

existing Ordnance Survey is quite good enough for any one, and an aeronautical map would be an unjustifiable luxury. Let us start on localities of which the maps are poor and which offer prospects of regular aerial traffic in the future. Calcutta to Rangoon and Singapore; Aden to Mombasa; Khartoum to Nairobi; and similar links, spring to the mind as the most useful field for our first efforts.

W. S. BRANCKER,
Major-General R.A.F. (Retired).

2, Dorset Street, London, W.1,
9 May 1921.

The Circulation of the Earth's Crust.

May I be allowed a word of comment on the subject of Colonel Tandy's paper in the May number, at the reading of which I could not be present?

The paper dealt mainly in generalizations, and I would suggest that the validity of the theory might be tested by looking at the actual facts of erosion and deposition in an area easy of study like the English Lake District. I select this as an area of marked relief within small compass, and one with which I am more intimately acquainted than perhaps any other of like extent. As assistant to Dr. Mill in his survey of the under-water contours of the lakes in 1893–94, my attention was naturally called to the problem of the origin of the heights and hollows, and in the discussion after Dr. Mill's paper I ventured to draw some conclusions—arrived at independently, but in accord, I believe, with those of other observers.* In trying to account for the fact that the deepest hollows seemed generally associated with the greatest heights, it occurred to me for a moment that the matter from beneath the hollows had, as I then expressed it, "gone to make the mountains" (by a somewhat similar process to that supposed by Colonel Tandy). But an examination of the facts showed that the idea did not square at all with these. The deepest hollows seemed everywhere to be portions less subject to deposition, while the shallower parts were everywhere associated with areas of degradation, the products of which had been transported into the original basins. The steepness with which the deltas of the main feeders fall to the depths has struck all observers, large masses of shingle and even blocks of some size being pushed out by the current and resting at the edge at an angle even steeper than that at which such *débris* rest above water, *e.g.* on the spoil-heaps of quarries. The forward advance of such deltas is very noticeable, even within a limited period, and in some cases (*e.g.* in Haweswater) bids fair to divide the lake into two basins, a stage which has been reached in the case of Buttermere and Crummock, Derwentwater and Bassenthwaite, respectively. Surely all this is directly opposed to Colonel Tandy's theory. Why, *e.g.*, should such deltas persist at all, instead of being engulfed in the subjacent rocks?

Dr. Evans has already criticized the main idea of the paper on the ground that it would furnish a case of perpetual motion. However this may be, it would seem at least to introduce a new principle—multiplication, in place of conservation, of energy. Is there not some similarity between the ideas put forward and those of a would-be inventor who should propose to use the heat generated by a continuous brake to accelerate the motion of the train? He too might meet objections by saying that he was not pretending to create new force, but merely to draw upon that supplied by the combustion of the coal.

* See *Journal*, vol. 6, p. 165. Mr. J. Y. Buchanan afterwards told me that he had arrived at similar conclusions in regard to the Scottish Lochs.

The question also suggests itself whether, if the principle of circulation is of such minute and general application as Colonel Tandy supposes, we should not be able to detect its effects almost everywhere in the distortion of strata where, as in mines, their present position can be actually traced underground. Should we, for example, find a seam of coal preserving a regular course for any distance anywhere? EDWARD HEAWOOD.

MEETINGS: ROYAL GEOGRAPHICAL SOCIETY: SESSION 1920–1921

Thirteenth Evening Meeting, 2 May 1921.—The President in the Chair.

ELECTIONS.—Herbert Arthur Baker; Miss Hilda Ann Hippisley Barnes; Reginald Bezzant; Albert Francis Barclay Bridges; John S. Burns; George Edward Nicholas Cheke; Lieut.-Col. Gerald Dalby, D.S.O.; Lawrence Thornewaite Grace, M.C., A.M.I.C.E.; Major W. G. G. Grant, M.C.; Captain George M. Harding; Commr. Richard Harrison, D.S.O., R.D., R.N.R.; Horace A. Hawkins; John Richard Hobhouse; Arthur L. Humphreys; Reginald John Kiker, D.D., LL.D.; Arthur T. Loyd; Henry Walter Maclean, C.M.G.; Al-Haj Massequoi; Captain Frederick Samuel Mateer, R.F.A.; Claude E. Matthews; Henry Leslie Morgan; The Rev. Thomas Paxton; Sir Charles Ross; T. H. Seaver; Thomas Shenton Whitelegge Thomas, O.B.E.; Joseph Edward Thornton; Henry Buswell Wetherell, M.A.

PAPER: Travels in Turkestan, 1918–1920. Captain L. V. S. Blacker.

Fourteenth Evening Meeting, 23 May 1921.—The President in the Chair.

ELECTIONS.—E. W. Barron; William Bensley Cotton; George Ashmore Fitch, B.SC.; Leopold A. Flint; Ralph A. Graves; Ahmed Hassanein Bey; George W. Johnson; Lieut. J. O. Lawson; Captain Robert Logan; Monsieur Hubert de Monbrison; Captain Donald C. Mudie, R.F.A.; Lieut.-Col. Cecil Rae; Dr. Alfred L. Sachs, M.A.; Lieut. A. R. W. Sayle, R.N.R.; Harold Schofield; Laurence Dudley Stamp; Mrs. Margaret Sully; Miss Mary Kathleen Langdon Thomas; Nicholas Tombazi; Miss Dorothy Wilford; Hubert Worsley Woolley, M.C., B.A.; Frederick R. Wulsin.

PAPER: Across the Libyan Desert to Kufara. Mrs. Rosita Forbes.

Seventh Afternoon Meeting, 9 May 1921.—The President in the Chair.

PAPER: On the Origin of Mountain Ranges. Col. Sir Sidney Burrard.

INDEX

* Denotes Articles and Papers.

§ Reviews and Notices.

A.

ABENDANON, E. C., Important Atlas in Brit. Museum, 284 *; on Homem's maps, 441
Abi Gamin, E., satellite of Kamet peak, 214
Abreu, A. de, voyage of, 437
Abruzzi, Duke of, Himalayan expln., 5, 11
Ægean Ids., 425
Aerodromes on aeron. maps, 347
Aeronautical Maps, Internat.: Lt.-Col. E. F. W. Lees, 152 (*title only*), 336 *; Maj.-Gen. Brancker on, 478
Aeroplanes in polar expln., 193
Ætolia province, Greece, 421
Africa—A—n Rift Valleys: J. W. Gregory on, 238; ditto: E. J. Wayland on, 239
——, E., Abflusslose Rumpfschollenland: E. Obst, 296 §
——, S., Control of Climate by Lakes: E. H. L. Schwarz, 166 *
——, S.W., Brit. and Portuguese Boundary Commns., 335
Agassiz, A., on Curaçao deep, 99
Aghurmi, Siwa oasis, 30
Ah, village, Elburz Mts., 402
Air Photographs, Mapping from: Lt.-Col. M. N. MacLeod, 141 §; Col. C. P. Gunter on, 398
Airships in polar expln., 193
Alaska and Yukon, Cheechako in: C. Cameron, 230 §
Alexander, Sir J. E., Travels on Orange River, 250
Alfonse, J., French navigator, 287
Allen, W. E. D., Turks in Europe, 294 §
Alluvial Plains and crustal circulation, 355
Alpheus valley, Peloponnese, 421, 422
Alpine Club and R.G.S., Joint Committee, 74
Altitudes, High, acclimatzn. and diet, 128
Amboina Id. in early atlas, 285
Amboland peneplain, 168–169; *see* Ovamboland
America, coasts in Egerton atlas, 286–287
——, S., early cartography of, 438 *et seq.*; Past and Present: L. C. Bollo, 467 §; States of: C. Domville-Fife, 467 §; Spanish, etc.: C. R. Enock, 467 §
American Ambassador, remarks on "Polar Expln.," 200
—— Geogr. Society, Developments at, 236
Amul, N. Persia, 404–406
Andaman basin, Indian seas, 96
Anglo-Saxon Nations, Expansion of: Ed. H. C. Barnard, 60 §
Angola, Rainfall in, 324–325
Anson's attempt to round Cape Horn, 253
Antarctic, Cope's Journey to, 151; Whaling, 187
Appalachian Coalfields, Northern, P. W. Bryan on, 147 §
Apsheron penins., Caspian, 162
Arabian deserts, meteorology, 172
Arcadia, upland plains of, 423
Arctic and Antarctic Expln.: Sir C. R. Markham, 469 §
Argolis plain, Greece, 424, 426
Argonaut Mt., Selkirks, 24
Arnold, J., Chronometer of, 265
Arthur, J. M., Mt. Kenya, 240 (*title only*)
Arun river, Himalaya, 3, 4, 5; route to Mt. Everest, 273, 274
Ashton, W., Evolution of Coast-line, 53 §
Asia, S.W., Baghdad to Caspian in 1918: Major-Gen. L. C. Dunsterville, 72 (*title only*), 154 *
Astronomer Royal, remarks on "History of Chronometer," 269
Atkinson, E. L., remarks on "Polar Expln.," 203
Atlantic, N., Ice Observn. in, 314
Atlas in British Museum: E. C. Abendanon, 284 *
Attica, plain of, 424
Audoin's Journey from Cameroon to Egypt, 146
Aughrabies Falls, Orange River, 241, 243
Augiéras, Capt., Sahara Occidental, 135 §; Journey in W. Sahara, 471
Australia, Cent., Native Reserves in, 234
Ayo caves, N. Persia, 403

B.

BAFFIN LAND, Macmillan's expdn. to, 285
Baghdad, In Clouds above: Lt.-Col. J. E. Tennant, 289 §
Bagoe River, W. Africa, Capture by Bandama, 167
Bailey, Major F. M., Visit to Bokhara in 1919..72 (*title only*), 75 *
Bak River, ravine, Orange River, 246, 247
Bakhtiariland, Lady Doctor in: E. N. M. Ross, 386 §
Baku, Fall of, 161–163
Baladen, Nur Valley, N. Persia, 410
Ball, J., on geology of Siwa oasis, 33
Ballantyne, A.: *see* Jenness, D.
Balmat, J., and — Paccard, first ascent of Mt. Blanc, 221, 222
Baltic Coasts, Currents along, R. Brückmann on, 309 §
Baltistan coolies, 6, 7
Bamboo for paper-making, 397
Bandama River, W. Africa, headstream erosion, 167
Banda Sea, S.E. Asia, 96, 99
Bara, Olympus region, Signification of, 210
Barfarush, N. Persia, 405, 407
Barker, W. H., and Rees, W., Making of Europe, 462 §

Barnard, H. C., Expansion of Anglo-Saxon Nations, 60 §
Barrell, J., on deltas and strength of crust, 359
Barth, H., ascents in Olympus group, 207
Bartlett deep, Mediterranean, 99
Basden, G. T., Among Ibos of Nigeria, 140 §
Baud-Bovy, D., Mountain Group of Olympus, 204 *
Behaim's globe and Toscanelli map, 435
Behring Strait, Region N. of, 183
Belgian Congo, Progress in, 147
Belgium and W. Front: Ed. F. Muirhead, 385 §
Bell, Miss G. L., Civil Administration of Mesopotamia, 463 §
——, W. G., Great Fire of London, 227 §
Bellot, Col., on map projections, 449
Bemmelen, W. van, Volcano studies in Malay Archipelago, 311 §
Berthoud, F., chronometer, 264
Bhotia guides, 278
Bicherakov, Col., 159, 160
Bichtes range, Olympus, 213
Bigmouth River, Selkirks, 23, 24
Bikandi Pass, Persia, 158
Biological Evolution, Climatic Cycles and, G. Taylor on, 396 §
Black bulb thermometer, 276
Blacker, Capt. L. V. S., Travels in Turkestan, 480 (*title only*)
Blanc, Mont, first ascents of, 221, 222; Traforo del M— B—, etc.: M. S. Govi, 385 §
Bligh's Second Voyage: I. Lee, 303 §; Journal of ditto, 476
Blue Back Chart, Story of, 144 §
Bœotia plain, 420
Böggild, O. B., on deposits in E. Indian archip., 98 *et seq.*
Bokhara, Visit to, in 1919: Major F. M. Bailey, 72 (*title only*), 75 *
Bollo, L. C., South America, Past and Present, 467 §
Bolsheviks in Turkistan, 75 *et seq.*
Bonacina, L. C. W., note on "Control of Climate by Lakes," 181
Borneo in early atlas, 286; Through Cent. B—: C. Lumholtz, 464 §
Boundary Demarcation, Belgian-German, 43 *
Bourgeois, Gen., Patron's Medal awarded, 392
Bown, L., on Boundaries of Wilts, 61 §
Brancker, W. S., letter on Internat. Aeron. Maps, 478
Brazil, early use of name, 439
Breguet, A. L., chronometer of, 267
Bridge, R. S., Geogr. of Commerce and Industry, 58 §
Brigham, A. P., Cape Cod and Old Colony, 389 §
Britain and Brit. Empire, Historical Geogr.: T. Franklin, 60 §
British Empire: B. C. Wallis, 391 §
—— Isles—Evolution of Coast: W. Ashton, 538 §
British Museum, Atlas in: E. C. Abendanon, 284 *
Brooks, C. E. P., on Climate of Falkland Ids., etc., 150 §
Browne, W. G., visit to Siwa, 29, 312
Bruce, Capt., and inscription to Capt. Cook, 35
——, Brig.-Gen. C. G., Mt. Everest, 1 *; attempt on Kamet, 214
Brückmann, R., on Currents along Baltic Coasts, 309 §
Bryan, P. W., on N. Appalachian Coalfield, 147 §
Buckley, A. B., Mesopotamia for Future Developt., 290 §
Bunsen, Sir M. de, remarks on "Scenery of Greece," 429
Burdalik, Turkestan, 83
Burdon, K. J., Handbook of St. Kitts-Nevis, 54 §
Burrard, Col. Sir S., on Origin of Mountain Ranges, 480 (*title only*); remarks on "Map Projections," 457, 459
Burton, Sir R. F., centenary of birth, 282
Bury, Col. C. H., appointed Chief of Everest Expdn., 74; Approaches to Mt. Everest, 121 *; Plans of Expn., 273
Butler, F. H., Fifty Years of Travel, 391 §
Buton trough, Malay Archip., 96

C.

CAMBRIDGE, Polar Research Inst. at, 199
Cameron, C., Cheechako in Alaska, 230 §
Cana, F. R., W. Sahara, 135
Canerio, N. de, World-map of, 435 *et seq.*
Canning River region, N. Alaska: E. Leffingwell, 65 §
Cantino Map, 437
Carbonate of Lime deposits, absence of, from Ocean Basins, F. F. Southby and Dr. Molengraaf on, 316
Caribbean mediterranean, 99
Carpenter, G. O. H., Naturalist on L. Victoria, 139 §
Casiquiare Canal, Rio Negro, etc.: H. H. Rice (*title only*), 320
Caspian Provinces of Persia: Capt. J. B. L. Noel, 401 *
—— sea-level, 161; Sea and deserts, 171
Cazana, Olympus region, meaning of, 210
Celebes basin, 99
—— Id. in Egerton atlas, 285
Cephalonia, "Sea-mills" of Argostoli, 62
Chad, Lake, hydrography, 171
Chalcis plain, Greece, 424
Chapman, Mt., Selkirks, 26
Chaves, A. de, lost map of, 441
Cheechako in Alaska: C. Cameron, 230 §
Chimbombe rapids, Kunene, 330
China, In Unknown: S. Pollard, 387 §
Chobe River, S. Africa, proposed weir, 170
Chronometer, History of: Lt.-Comm. R. T. Gould, 72 (*title only*), 253 *
Clamorgan, J. de, Harrisse on map of, 288
Clementi, Mrs. C., Through Brit. Guiana to Roraima, 466 §
Clifford, Sir H., on death of Mungo Park, 130, 131

Climate, Control of, by Lakes: E. H. L. Schwarz, 166 *
Climatic Cycles and Biol. Evolutn., G. Taylor on, 396 §
Close, Col. Sir C., Note on Doubly-Equidistant Projection, 446 *
——, McCaw, C. T., and Hinks, A. R., Notes on Map Projections, 320 (*title only*)
Coal: J. H. Ronaldson, 462 §; C— in Gt. Britain: W. Gibson, 462 §
Coast-line, Evolution of: W. Ashton, 53 §
Cock's Comb, Olympus, 209, 211
Cod, Cape, and Old Colony: A. P. Brigham, 389 §
Cohen, Col. J. W., remarks on "Internat. Aeron. Maps," 351
Collie, N., Approach to Mt. Everest, 272; De Saussure: review, 219 §; remarks on "Mount Everest," 16
Colonial Office, Middle East Dept., 310
Columbia River, 21, 22, 25
Columbus and Toscanelli map, 435
Commerce and Industry, Geogr. of: R. S. Bridge, 58 §
Cook, Capt., Two Early Monuments to: Capt. Lord Claud Hamilton, 35 *
Copais Lake, Bœotia, 420
Cope's Journey to Antarctic, 151
Coral Reefs, distribn., Malay Archip., 110
Cordier, H., Ser Marco Polo: Notes and Addenda, 143 §
Cordilleras, S. American, Swedish Explns., 149
Corinth, Gulf of, shores, 422
Cornell, F. C., obituary, 398; Lower Reaches of Orange River, 240 (*title only*), 241 *
Corney, B. G., remarks on "World-Map before and after Magellan," 443
Cracow globe and Indian Ocean, 439
Cristaci summit, Olympus, 212, 213
Crommelin, A. C. D., on eclipses and death of M. Park, 132
Crooke, W., Annals . . . of Rajasthan: Lieut.-Col. J. Tod, 137 §
Cumberland, George, Third Earl of, Life and Voyages: G. C. Williamson, 59 §
Cundall, F., and Pieterz, J. H., Jamaica under Spaniards, 299 §
Curaçao deep, Caribbean Sea, 99

D.

Dale, Capt. A. M.: *see* Smith, E.
Daly, R. A., glacial-control theory, 100; on Possible General Fall of Sea-level, 66 §; "Nomenclature of N. American Cordillera" quoted, 26
Damavand, Mt., Elburz, 402, 403
Danish Expdn., N. Greenland, 66
Danube: Historical, Political, etc.: H. Hajnel, 294 §
Darius, Rock inscriptions of, 157
Darud Mt., Elburz, 402
Davidson, N. J., Modern Travel, 306 §
Dead Sea, Deeps of, 356
Dead Towns and Living Men: C. L. Woolley, 144 §
Death Rapids, Columbia River, 28
Debenham, F., Future of Polar Exploration, 152 (*title only*), 182 *
Deck, Dr. N., on Rennell Id., 474
Deep-sea Research in E. Indian Archip.: G. A. F. Molengraaff, 95 *
Deeps and crustal circulation, 355, 356
Delos, Ægean, 425
Deltas and crustal circulation, 359–361
Demangeon, Prof., on Port of Paris, 392 §; on Farm Buildings in France, 308 §
D'Entrecasteaux, N.: D. Jenness and A. Ballantyne, 301 §
Denucé, J., and Reinel maps, 437
Desceliers maps, 285 *et seq.*; S. continent in, 442
Desliens maps, 285 *et seq.*
Ditton: *see* Whiston
Dog, value in polar transport, 192
Domville-Fife, C., States of S. America, 467 §
Downie River, Trib. of Columbia, 27
Drift Seeds, Tropical, on Irish Coasts, H. B. Guppy on, 307 §
Dunsterville, Major-Gen. L. C., Baghdad to Caspian in 1918..72 (*title only*), 154 *
Durham, Northumberland and, Place-names in: A. Mawer, 292 §
Dutton, C. E., and Isostasy, 354

E.

Earle, W., on submarine topography, E. Ind. Archip., 100
Earnshaw, T., chronometer of, 265–267
Earth's Crust, Circulation in: Lt.-Col. E. A. Tandy, 240 (*title only*), 354 *; letter by E. Heawood, 479
East, Far, Typhoons of, L. Froc on, 312 §
——, Middle, Dept. of Colonial Office, 310
—— Indian Archip., Deep-sea Research: G. A. F. Molengraaff, 95 *; Volcano studies in, W. van Bemmelen's, 311
Education, Geography as Pivotal Subject in: Sir H. Mackinder, 376 *
Edwards, F. A., on Siwa oasis, 312
Egerton 1513 atlas in British Museum, 284 *et seq.*, 397
Elburz Mts., Persia, 402, 409
Elsenborn camp, German frontier, 50
Enock, C. R., Spanish America, etc., 467 §
Eratosthenes, on size of Earth, 431
Erichsen, M., Greenland journey, 185
Erickson's Drift, S. Africa, 327; spelling of name, 336
Eredia, F., on Rainfall of Jerusalem, 63 §
Etosha Pan, S. Africa, 170
Eupen, Kreis of, 44
Europe—Belgian-German Boundary Demarcation, 43 *; Making of: W. H. Barker and W. Rees, 462 §; University Library for Cent. E—, 235
Evans, J. W., remarks on "Circulation in the Earth's Crust," 372; on "Control of Climate by Lakes," 179; on "Deep-sea Research in E. Ind. Archip.," 119
Everest, Mt., Brig.-Gen. C. B. Bruce, 1 *; Discussion: erratum, 152; Expdtn., 73, 232, 394, 460; ditto, Organization and

Equipment, 271,* 320 (*title only*); Obsns. on Approaches to: Lt.-Col. C. H. Bury, 121 *

F.

FAGAN, C. E., obituary, 237
Fairgrieve, J., and Young, E., Human Geogr., 58 §
Falkland Ids. and S. Georgia, Climate, C. E. P. Brooks on, 150 §
Farahabad, N. Persia, 405, 408
Farm Buildings in France, Prof. Demangeon on, 308 §
Farquhar, —, ascent of Skolion, Olympus, 209
Farrer, R., obituary, 69
Fawcett, H. A.: see Goff, A.
Fifty Years of Travel: F. H. Butler, 391 §
Finch, G., high climbing on Everest, 278
Finé, O., "Terra Australis" in map of, 442
Fish River, junction with Orange, 249
Fitzmaurice, Lord, on Boundaries of Wiltshire, 61 §
Flack, Major, Mercury manometer for high altitudes, 129
Fletcher, E. B., Stevenson's Germany, etc., 468 §
Flores basin, Malay Archip., 96
Florida Wilds, In Lower: C. T. Simpson, 141 §
Foerster, R. F., Italian Emigration, 305 §
Fontainebleau, Lost atlas of, 289
Forbes, Mrs. R., Across Libyan Desert to Kufara, 480 (*title only*)
Forests and Human Progress: R. Zon, 315 §; and rainfall, 172
France, Farm Buildings, Prof. Demangeon on, 308 §
Franklin, T., Hist. Geogr. of Britain and Brit. Empire, 60 §
Frazer, Sir J. G., Mackie Ethnol. Expdn., 234 §
French Creek, Selkirks, 24
French Equatorial Africa, Audoin's journey, Cameroon to Egypt, 146
"Frenchman's Cap," Gold Range, 22, 23
Freshfield, D. W., Life of H. B. de Saussure, 53 §, 219 §; remarks on "Mount Everest," 17; "Summits of Olympus" quoted, 205, 206
Frisius, G., and chronometer, 253
Froc, L., on Typhoons, 312 §

G.

GANE, O. M., Appeal for inhab. of Tristan da Cunha, 313
Garden of Eden, War in: K. Roosevelt, 289 §
Gastaldi's world-map, 442
Geodesy: G. L. Hosmer, 231 §
Geographical Assoc., 376, 379; *G— Journal*, appeal for copies, 235; G— Names, Permanent Committee on: Major-Gen. Lord Edward Gleichen, 36 *, 316; Spelling: erratum, 152
Geography as pivotal subject in Education: Sir H. Mackinder, 376 *; G—, Modern, Groundwork of: A. Wilmore, 392 §; Cours de G—: I. Halkin, 307 §
Geology and Polar Expln., 191
Germany, Stevenson's, etc.: E. B. Fletcher, 468 §
Gibbs, L. S., on Flora of Summit-plateaux of Tasmania, 473 §
Gilan province, Persia, 414
Gleichen, Major-Gen. Lord E, Permanent Committee on Geogr. Names, 36 *
Glenconner, Baron, obituary, 67
Goff, A., and Fawcett, H. A., Macedonia: Plea for Primitive, 226 §
Gold, E., remarks on "Control of Climate by Lakes," 174
Gold Range and N. Selkirks, B.C., Topography of: H. Palmer, 21 *
Goldstream, trib. of Columbia River, 27
Gomme, A. W., Scenery of Greece, 400 (*title only*), 418 *
Gonneville, De, confusion as to voyage, 439
Goodhouse farm, fertility, Namaqualand, 248
Gorceix, —, ascents in Olympus group, 207
Gordonhorne Mt., Gold Range, 23
Gould, Lt.-Comm. R. T., History of Chronometer, 72 (*title only*), 253 *
Govi, M. S., Traforo del Monte Bianco, etc., 385 §
Graham, climb of peak near Kabru, 281
———, G., and Harrison's chronometer, 256
Gray, Sir A., remarks on "World Map before and after Magellan," 445
Gt. Britain, Coal in: W. Gibson, 462 §
"Grèce Immortelle" quoted, 206
Greece, Scenery of: A. W. Gomme, 400 (*title only*), 418 *
Greek Lands, Discovery in: F. H. Marshall, 54 §
Greenbie, S., Japan, Real and Imaginary, 228 §
Greenland, N., Danish Expdn., 66, 183
Gregory, J. W., on African Rift Valleys, 238
Grist, W. A., Samuel Pollard, 387 §
Gunter, Lt.-Col. C. P., Letter on Mapping from Air Photographs, 398
Guppy, H. B., Tropical Drift Seeds on Irish Coasts, 307 §
Gurla Mandhata Massif, Himalayas, 218; attempted ascent by Dr. Longstaff, 10
Gurna, Olympus region, meaning of, 210

H.

HADFIELD, Mrs. E., Among Natives of Loyalty Group, 390 §
Hajnel, H., Danube: Hist., Polit., and Econ., 294 §
Halkin, I., Cours de Géogr., 307 §
Halmahera Id. in Egerton atlas, 285
Hamberg, A., on Ice Movements in L. Sommen, 393 §
Hamilton, Capt. Lord Claud N., Two Early Monuments to Capt. Cook, 34 *
———, R. W., on Sultanate of Witu, 70

Hamilton-Browne, W., on death of Mungo Park, 131
Handbooks of Naval Intelligence Div., Admiralty, 51 §
Harhaz valley, N. Persia, 403, 404
Harleian mappemondes, 285 *et seq.*
Harrisse, H., on Atlas in British Museum, 284; on Clamorgan's ditto, 288; on voyage of J. Cartier, 289
Harrison, J., chronometer, 256 *et seq.*
Haug, E., on crustal warping in Moluccas, 109
Heawood, E., letter on Circulation of Earth's Crust, 479; World Map before and after Magellan's voyage, 400 (*title only*), 431 *
Herbertson, A. H., and Oxford School of Geogr., 378
Heuzey, L., ascents in Olympus group, 207, 210
Hill, L., Rubber Bag and Oxolith for high altitudes, 127
Hill shading in aeron. maps, 343–345
Himalayas—and crustal circulation, 370; H—n local names, 14; Naturalist in H—: R. W. G. Hingston, 387 §; snow line in, 123
Hingston, R. W. G., Naturalist in Himalaya, 387 §
Hinks, A. R., Projection adopted for Allied Maps on W. Front, 448*; Projection of Sphere on Circumscribed Cube, 454*; remarks on "Circulation of Earth's Crust," 374; on "Hist. of Chronometer," 270; on "Internat. Aeron. Maps," 352–354; *see* Close, Col. Sir C.
Hjort, J.: *see* Murray, J.
Hoetink, B., Origin of name Quelpaert, 310 §
Homem, L., maps of, 441
Hosmer, G. L., Geodesy, 231 §
Hottentot rebellion, 1902–3..248
Hudson's Bay Company—Governor and Company . . . trading into H— B— . . .: Sir W. Schooling, 298 §
Hugershoff and Cranz, Photogrammetrie aus Luftfahrzeugen, 304 §
Human Geogr.: J. Fairgrieve and E. Young, 58 §
—— Progress, Forests and, R. Zon on, 315 §
Huyghens, C., marine timekeeper, 255
Hydrographer, The, remarks on "History of Chronometer," 268

I.

Ibos of Nigeria: G. T. Basden, 140 §
Ice Observn. in N. Atlantic, 314
— Movements in L. Sommen: A. Hamberg, 393 §
Ila-speaking Peoples of N. Rhodesia: E. Smith and Capt. A. M. Dale, 228 §
India, Diary of Sportsman Naturalist in: E. P. Stebbing, 138; Drainage System, Ancient, of N. I—, E. H. Pascoe on, 62 §
Industry, Geogr. of Commerce and: R. S. Bridge, 58 §
Ionian Ids., scenery, 419
Irish Coasts, Tropical Drift Seeds on, H. B. Guppy on, 307 §
Irrigation, effect on atmospheric humidity, 172
Islands Far Away: Miss A. G. King, 230 §
Isostasy and circulation, 354
Italian Emigration of Our Times: R. F. Foerster, 305 §
——— Geogr. Congress, Eighth, 236

J.

Jack, Col. E. M., remarks on "Map Projections," 457; on "Internat. Aeron. Maps," 348; Scientific equipt. of Everest expedn., 276
Jackals Berg, Orange River, 250
Jacques-Philippe peak, Olympus, 206, 208, 211
Jajarud, town and river, N. Persia, 402
Jalobert, M., possible author of Egerton atlas, 289
Jamaica under Spaniards: F. Cundall and J. H. Pietersz, 299 §
Jamdena Id., E. Indies, reef terraces, 115
Japan, Harvest of: C. B. Luffmann, 139 §; J—, Real and Imaginary: S. Greenbie, 228; J— in Egerton atlas, 285
Java in Egerton atlas, 285
—— trough, E. Indies, 96
Jenness, D., and Ballantyne, A., N. D'Entrecasteaux, 301 §
Jerusalem, Rainfall of, Prof. Eredia on, 63 §
Jessen, O., on glacial cirques in Vosges, 145 §
Johannesburg Observ., evapn. records, 172
Johns Hopkins Univ., Geogr. Lectures, 236
Johnson, D. W., quoted, 368
Johnston, Sir H. H., Review of 'Abflusslose Rumpfschollenland in . . . Ostafrika': E. Obst, 296 §; of 'Ila-speaking Peoples of N. Rhodesia,' 228 §; of 'Naturalist on Lake Victoria,' 139 §; of 'Siwi Language,' 465 §
Jupiter Ammon, Temple of, 29, 31

K.

Kabru, Mt., Himalayas, 11, 12
Kakamas, Orange River, 242
Kalahari basin, 173
Kaleh Dasht, N. Persia, 411
Kalogeros, peak, Olympus, 205 *et seq.*
Kamet, Mt., Himalayas, attempt on, 12; Kellas' Expdn., 124*; Meade's camp on saddle, 64; Rept. on Expdn., 1920: Major H. T. Morshead, 213 *
Kangchenjunga, Mt., reconnaissance, 275
Kanthack, F. E., Notes on Kunene River, 321*; remarks on "Control of Climate by Lakes," 175
Kapuas river, W. Borneo, 102, 104
Karij river, Persia, 160
Kavale Rapids, Kunene, 329, 330
Kellas, A. M., Expdns. to Kamet, 124*, 214 *et seq.*, 277, 279; Himalayan explns., 12
Keltie, Sir J., and geogr. educatn., 377
Kendall, L., and Harrison's chronometer, 261, 262
Kent, Symonson's map of, 1596..232

Kenya, Mt.: J. M. Arthur, 240 (*title only*)
King, Miss A. G., Islands Far Away, 230 §
Kipling, R., Letters of Travel, 1892–1913.. 144 §
Kitson, A. E., on Black Volta, 167
Klephtes, brigands, Mt. Olympus, 207
Knox, A., on Translt n. of Place-names, 40
Kokkino-Vrako range, Olympus, 213
Kropotkin, Prince, obituary, 316
Kuchik Khan, Persian revolutionary, 154, 159, 160
Kunene River, hydrology, 168–170; notes on: F. E. Kanthack, 321 *
Kut and Captivity, In: Major E. W. C. Sandes, 289 §

L.

LABRADOR in Egerton atlas, 286
Lady Doctor in Bakhtiariland: E. N. M. Ross, 386 §
Lagrange projection, 451 *et seq.*
Lakes, Control of Climate by: E. H. L. Schwarz, 166 *
———, Gt., N. America, Rainfall and Evaptn., 172; ditto, C. Africa, 173
Lambert's conical orthomorphic projection, 449, 450
Lamothe, R. de, on headstream erosion in W. Africa, 167
Lands of Silence, etc.: Sir C. R. Markham, 469 §
Larissa plain, 420
Lauzanne, Major, journey in W. Sahara, 471
La Valley, Elburz Mts., 403
Layer colouring in aeron. maps, 243 *et seq.*
Lee I. (Mrs. C. B. Marriott), Capt. Bligh's Second Voyage, 303 §
Lees, Lt.-Col. E. F. W., Internat. Aeron. Maps, 152 (*title only*), 356 *
Leffingwell, E., Canning River region, N. Alaska, 65 §
Leibnitz's marine timekeeper, 255
Leiviskä, I., Salpausselkä, 295 §
Leland, Lt.-Col. F. W., With M. T. in Mesopotamia, 289 §
Lenox globe-map and Indian Ocean, 439
Lenox-Conyngham, Col. Sir G., remarks on "Circulation of Earth's Crust," 371
Le Roy, P., chronometer, 263, 264
Libyan Desert, Across, to Kufara: Mrs. R. Forbes, 480 (*title only*)
Light vessels, etc., on aeron. maps, 347
Lloyd, Capt., remarks on "Intern. Aeron. Maps," 352
London, Great Fire of: W. G. Bell, 227 §
Longitude, Board of, 255
Longstaff, attempt on Gurla Mandhata and Trisul, Himalayas, 12; on Kamet, 214; remarks on "Mount Everest," 18
Loyalty Group, Among Natives of: Mrs. E. Hadfield, 390 §
Luffmann, C. B., Harvest of Japan, 139 §
Lumholtz, C., Through Central Borneo, 464 §

M.

MCCAW, C. T., Modified Rectangular Polyconic Projection, 451 *
McCulloch Creek, Goldstream, B.C., 27
Macedonia: Plea for Primitive: A. Goff and H. A. Fawcett, 226 §
Mackie Ethnol. Expdn., 234
Mackinder, Sir H., Geography as Pivotal Subject in Education, 376 *
Maclehose, O., Katherine Stuart Macqueen, 293 §
MacLeod, Lt.-Col. M. N., Gill Memorial awarded, 392; Mapping from Air Photographs, 141 §
Macmillan, D., Expdn. to Baffinland, 235
Macqueen, Katharine Stuart: Memoir: O. Maclehose, 293 §
Magellan's Voyage, World Map before and after: E. Heawood, 400 (*title only*), 431 *
Makarikari depression, S. Africa, 170
Maldonado, L. F., inventor of a "compass without variation," 254
Malmédy, Kreis of, boundary, 48–50
Manometer, Flack's, for high altitudes, 129
Mapping from Air Photographs: Lt.-Col. M. N. MacLeod, 141 §; letter by C. P. Gunter, 400
Map Projections, Notes on: Col. Sir C. F. Close, C. T. McCaw, and A. R. Hinks, 320 (*title only*), 446 *; Some Investigations into Theory of: A. E. Young, 133 §
Marco Polo, Ser: Notes and Addenda: H. Cordier, 143 §
Marett, R. R., Preface to 'Northern D'Entrecasteaux,' 301 §
Marinus of Tyre, on size of Earth, 432
Marocco, Economic position in, 395
Markham, Sir C. R., Lands of Silence, etc., 469 §
Marriott, Mrs. C. B.: *see* Lee, I.
Marshall, F. H., Discovery in Greek Lands, 54 §
Martellus, H., world-map of, 435
Masters, H. and W. E., In Wild Rhodesia, 297 §
Maury, Commdt., Murchison Grant to, 392
Mawer, A., Place-names of Northumberland and Durham, 292 §
Mawson's Antarctic Expdn., 185
Maxwell, D., Dweller in Mesopotamia, 290 §
Mazandaran, Persia, 401 *et seq.*
Meade, C. F., expdns. to Mt. Kamet, Himalayas, 12, 214; Camp on Kamet Saddle, 64; on heights of Olympus peaks, 210; remarks on "Mount Everest," 20; Stores and Equipment, Everest Expdn., 277
Mediterranean seas, 95
Mentawei basin, Malay Archip., 96
Mercator's Projection for aeron. maps, 338, 478
Meshed-i-Sar, N. Persia, 405, 407
Mesopotamia, Dweller in: D. Maxwell, 290 §; M— for Future Develpt.: A. B. Buckley, 290 §; M— and War, 289; Marvellous M—: J. T. Parfit, 289 §; My Campaign in: Major-Gen. Sir C. V. F. Townshend, 289 §; Review of Civil Administn.; Miss G. L. Bell, 463 §; Wanderings with Camera: A. Vowles, 289 §; with M. T. in: Lt.-Col. F. W. Leland, 289 §

Meteorology: W. I. Milham, 55§; Introductory M—, 56§; M— and Polar expln., 188, 189
Meyjes, R. P., Reizen van Abel J. Tasman, etc., 302§
Mica Creek, Selkirks, 25
Michell, H., Geogr. of Sierra Leone, 139§
Mikro-Gurna abyss, Olympus, 208
Milham, W. I., Meteorology, 55§
Minutoli, visit to Siwa, 31–32
Molengraaff, G. A. F., Deep-Sea Research in E. Ind. Archip., 95*; errata, 311; on absence of carbonate of lime deposits from deep basins, 316
Molopo River, junction with Orange, 246
Molyneux, A. J. C., obituary, 319
Monrad Aas: *see* Rubenson
Montagnier, H. F., contributions to Freshfield's 'Life of H. B. de Saussure,' 53§, 219§
Monte Negro Rapids, Kunene, 334
Moresnet, territory of, 44
Morgan, P. G., limestone resources of New Zealand, 149§
Mori, A., Distribn. of Popultn. in Sicily, 470§
Morshead, Major H. T., Expdn. to Kamet, 1920..213*, 277, 279
Mountain Craft: G. W. Young, 224§
——— Ranges, On Origin of: Col. Sir G. Burrard, 480 (*title only*)
——— Sickness, 128
Mountaineering Art: H. Raeburn, 224§
Mudge, T., marine timekeeper by, 262, 263
Muirhead, F., Belgium and W. Front, 385§
Mummery's attempt on Nanga Parbat, 12
Murray, Sir J., and Hjort, J., on Curaçao deep, 99
——— and Philippi, E., on Curaçao deep, 99
——— and Renard, on deposits in Malay Archipelago, 98
Musi river, Sumatra, 102, 104
Myres, J. L., remarks on "Scenery of Greece," 428

N.

Namcha Barwa, Himalayas, 213
Nanda Devi, Himalayas, 213
Nanga Parbat, Himalayas, Mummery's attempt on, 12
Nansen, F., remarks on "Deep-sea Research in E. Ind. Archip.," 118
Netherlands Minister, H.E., remarks on "Deep-sea Research in E. Ind. Archip.," 120
Newbigin, Miss M., Back Grant to, 392
Newton, Sir I., on chronometer method for longitudes, 255
New Zealand, Limestone Resources, P. G. Morgan, 149§
Niger River, decrease of volume, 168
Nigeria, Ibos of: G. T. Basden, 140§
Noel, Capt. J. B. L., Cuthbert Peek Grant to, 392; on mountain photography, 280; Reconnaissance in Caspian Provinces of Persia, 152 (*title only*), 401*
Nordenskjöld, O., Expedn. to S. America, 149, 472
Northumberland and Durham, Place-names of: A. Mawer, 292§
Nur Valley and Province, N. Persia, 409, 410
Nyasa, Early Portuguese Knowledge, G. Schurhammer on, 313§

O.

Obst, E., Abflusslose Rumpfschollenland in . . . Ostafrika, 296§
Ocean Basins, Absence of carbonate of lime deposits from, F. F. Southby and Dr. Molengraaff on, 316
Oceanography and Polar expln., 189–192
O'Dwyer, Sir M., remarks on "Visit to Bokhara," 87
Oil Palm as Plantation Crop, 151
Okavango River, hydrography, 170, 322 *et seq.*; O— Region, S. Passarge on, 64§
Olympia, Peloponnese, 421
Olympus, Mountain Group of: D. Baud-Bovy, 204*
Orange River, Lower Reaches: F. C. Cornell, 240 (*title only*), 241*
Orinoco, Upper, Rio Negro . . . and: H. H. Rice, 320 (*title only*)
Ortelius, World-map of, 442
Ovamboland plain, 327; name, 336
Ovashimba tribes, Kaokoveld, 335
Oxygen for high altitudes, 126–127; O— Research Committee, 214

P.

Paccard, — : *see* Balmat, J.
Pacific Ocean, early ideas of width, 435–6; in Finé's map, 442; in Ribero's, 440
Palmer, H., Topography of Gold Range and N. Selkirks, 21*
Papal Bulls and Spanish and Portuguese rights, 432, 433
Paper-making, Bamboo for, 397
Parfit, J. T., Marvellous Mesopotamia, 289§
Paris, Port of, Prof. Demangeon on, 392§
Park, Mungo, death of, 130
Pascoe, E. H., on Ancient Drainage of N. India, 62§
Passarge, S., on Okavango Region, S.W. Africa, 64§
Pastoret, or Pasterot, Atlas attributed to, 284 *et seq.*
Patagonia, Dr. O. Nordenskjöld's Expdn. to, 472; West P—n: H. Steffen, 300§
Peacock, N., Russian Almanac, 1919.. 137§
Pella mission station, Orange River, 247
Peloponnese, Scenery of, 421
Peneus river, Thessaly, 420
Persia, Caspian Provinces of: Capt. J. B. L. Noel, 152 (*title only*), 401*; From Baghdad to Caspian in 1918: Maj.-Gen. L. C. Dunsterville, 154*; Persian plateau, 153; South P— and Great War: Brig.-Gen. Sir P. Sykes, 400 (*title only*); West P—, Trough-faulting in: S. J. Shandon, 233§
Peterborough: K. E. and R. E. Roberts, 53§

Philippi, E. : *see* Murray, Sir J.
Philippson, A., on plain of Larissa, 420
Photogrammetrie aus Luftfahrzeugen : Profs. Hugershoff and Cranz, 304 §
Phoutrides, —, ascent of Skolion, Olympus, 209
Pieterz, J. H. : *see* Cundall, F.
Pilgrim, H. G. E., on Ancient Drainage of N. India, 62 §
Pindus range, 421
Plant, Capt. S. C., obituary, 477
Pocock, I. S., surveys on Kamet Mt., 214
Polar Expln. [Research], Future of: F. Debenham, 152 (*title only*), 182 *; Research Institute, 198–200
Pole, Northern, of Inaccessibility, Stefansson on, 234 §
Pollard, Samuel (Biography) : W. A. Grist, 387 § ; In Unknown China, 387 §
Poole, Major F. G., remarks on "From Baghdad to Caspian," 165
Portugal, Partition of World between Spain and, 432 *et seq.*
Portuguese cartography, Early, 435 *et seq.*
Posidonius, on size of Earth, 432
Priest Rapids, Columbia River, 28
Ptolemy's influence on Cartography before Magellan, 432, 435, 436

Q.

QUARITCH, Messrs., and Cartography of Magellan's voyage, 440, 441
Quelpaert, Origin of name : B. Hoetink, 310 §

R.

RAEBURN, H., leader of Everest reconnaissance, 74; Mountaineering Art, 224 §; Mountaineering work of Everest Expdn., 275
Raikane valley and glacier, Kamet, 214
Railways on aeron. maps, 340–342, 346
Rajasthan, Annals, etc. : Lt.-Col. J. Tod, 137 §
Raman's Drift, Orange River, 247
Reade, T. M., quoted on "Earth Structure," 367
Rees, W. : *see* Barker, W. H.
Reeves, E. A., remarks on "Map Projections," 459
Reinel maps, 437–439
Relief in aeron. maps, 343 *et seq.*
Rennell Id., Pacific, Dr. N. Deck on, 474
Reynolds, J. H., work on Alphabets and Orthography, 38
Rhodesia, In Wild : H. and W. E. Masters, 297 § ; Future of, 312 ; Northern R—, Ila-speaking peoples : E. Smith and Capt. A. M. Dale, 228 §
Ribero's map, results of Magellan's voyage in, 440
Rice, H. H., Rio Negro, Casiquiare Canal and Upper Orinoco, 320 (*title only*) ; Honour to, 67
Richter, E., attempt to ascend Olympus, 207
Richtersveldt region, Orange River, 241, 248
Riefler clock, 258
Ritchie, J., Infl. of Man upon Animal Life in Scotland, 384 §
Rivers and crustal circulation, 355 *et seq.*
Roads on aeron. maps, 341, 342, 346
Roberts, K. E. and R. E., Peterborough, 53 §
Rocky Mt. Trench, 25
Rohlfs, G., visit to Siwa, 32
Ronaldson, J. H., Coal, 462 §
Roosevelt, K., War in Garden of Eden, 289 §
Roraima, Through B. Guiana to : Mrs. C. Clementi, 466 §
Ross, E. N. M., Lady Doctor in Bakhtiariland, 386 §
Ross Sea, whaling, 187
Roti Id., E. Indies, reef terraces, 115
R.G.S. and Geogr. educatn., 377 *et seq.*
—— Medals and Awards, 1921 .. 392
—— Meetings and Elections, 71, 152, 240, 320, 480
—— and Alpine Club, Joint Committee, 74
Rua Cana falls, S. Africa, 326 ; etymology, 336
Rubenson and Monrad Aas, Attempt on Mt. Kabru, 11, 12
Rudolf Lake, hydrography, 171
Russian Almanac, 1919 : N. Peacock, 137 §
—— monopoly of N. Persia, 404
Ruysch's map, 435
Rycroft, Maj.-Gen., ascent of St. Elias peak, Olympus, 209

S.

SAFID RUD, river, N.W. Persia, 156, 158
Sahara, W., French Expln., 471 ; S— Occidental : Capt. Augiéras, 135 §
Sahul shelf, or Australian bank, 100, 107
St. Anthony summit, Olympus, 206, 212, 213
St. Elias peak, Olympus, 206, 207, 210, 213
St. Kitts-Nevis : K. J. Burdon, 54 §
Saleyer trough, E. Indies, 96
Salpausselkä (Finland) : I. Leiviskä, 295 §
Sandes, Major E. W. C., in Kut and Captivity, 289 §
Santa Cruz, A. de, errors in map, 441
Sarai summit, Olympus, 213
Sarasin, P., on crustal warping in Moluccas, 109
Saussure, Horace Benedict de, Life of : D. W. Freshfield, 53 §, 219 §
Savu basin, E. Indies, 96
Saxaul bush, Turkestan, 84
Sayce, A. H., centenary notice of Sir R. F. Burton, 282
Schlagintweit, A. and R., attempt on Kamet Mt., 214
Schöner, globe-map and knowledge of Magellan's Strait, 439
Schooling, Sir W., . . . Adventurers of England trading into Hudson's Bay . . ., 298 §
Schurhammer, G., Early Portuguese Knowl. of Lake Nyasa, 313 §
Schwarz, E. H. L., Control of Climate by Lakes, 166 *
Scotland, Influence of Man on Animals : J. Ritchie, 384 §
Scotswoman, Records of (K. S. Macqueen) : O. Maclehose, 293 §

Scott Polar Institute, 198–200
Sea-level, Possible general fall of, R. A. Daly on, 66 §
"Sea-mills" of Argostoli, Cephalonia, 62 §
Seaplanes in polar expln., 194
Selkirks, N., Gold Range and : H. Palmer, 21 *
Senussi campaign, 33
Serra Cana ridge, Kunene, 331 ; etymology of name, 336
Serrão, F., Correspondence with Magellan, 434
Shackleton, Sir E., Antarctic Expn., 186 ; remarks on "Future of Polar Expln.," 201
Shand, S. J., on trough-faulting in W. Persia, 233 §
Sherpa Bhotias, as coolies, 8, 123
Shipping, Infl. of War upon : J. R. Smith, 57 §
Shuckburgh, J. E., at Middle East Dept., Colonial Office, 310
Siam, Trade and Communications in, 63
Siboga Expdn. to E. Indies, 96
Sicily, Population in, A. Mori on, 470 §
Sierra Leone, Introduction to Geogr. of : H. Michell, 139 §
Simonelli, —, on "Sea-Mills" of Argostoli, 62 §
Simpson, C. T., In Lower Florida Wilds, 141 §
———, G. C., remarks on "Future of Polar Expln.," 202
Sinai Desert winds, W. Späth on, 309 §
Singkep Id., E. Indies, tin ore deposits, 103
Siwa, Oasis of, Modern Expln. in : W. S. Walker, 29 * ; F. A. Edwards on same, 312
Siwi Language : W. S. Walker, 465 §
Skolion peak, Olympus, 205, 206, 213
Slingsby, Capt. A. L., Attempt on Kamet, 12, 214
Smet, De, on rapids of Columbia River, 28
Smith, E., and Dale, Capt. A. M., Ila-speaking Peoples of N. Rhodesia, 228 §
———, J. R., Infl. of War upon Shipping, 57 §
———, Lt.-Col. Sir J. R. D., obituary, 476
Sommen, Lake, Sweden, Ice Movements, A. Hamberg on, 393 §
Southby, F. F., on Absence of carbonate of lime deposits from Ocean Basins, 316
"Southern Continent" in Egerton atlas, 288
South Georgia, etc., Climate of, C. E. P. Brooks on, 150 §
—— Sea, Bligh's Second Voyage to : I. Lee, 303 §
South-West Africa Protectorate, Rainfall of, 324
Späth, W., on Sinai Desert winds, 309 §
Spice Ids. in Magellan's time, 434, 437
Spitsbergen, Present Day Conditions in : J. M. Wordie, 320 (*title only*)
Sportsman Naturalist in India : E. P. Stebbing, 138 §
Srimangal Earthquake, 8 July 1918, M. Stuart on, 311 §
Stalamata, meaning of, Olympus region, 210
Stanley, Capt. C. V., visit to Siwa, 32
Stavoïdia, domes, Olympus, 213
Stebbing, E. P., Sportsman Naturalist in India, 138 §
Stefansson, V., Arctic expdn., 183, 195, 196 ; on N. Pole of Inaccessibility, 234 § ; Founder's Medal awarded to, 392
Steffen, H., W. Patagonien, 300 §
Stein, Sir A., remarks on "Visit to Bokhara," 87
Steindorff, visit to Siwa, 32
Stevenson's Germany, etc. : E. B. Fletcher, 468 §
Stewart, C. M., on S. African drought, 173
Stuart, M., on Srimangal Earthquake, 1918..311 §
Stuck, Archdeacon H., obituary, 68
Suess and developt. of geogr., 379
Sully, S., marine timekeeper, 256
Sultan Bulaq pass, Persia, 158
Sulu basin, E. Indies, 97
Sumba Id., E. Indies, reef terraces, 115
Sunda shelf or Asiatic bank, 100 *et seq.*
Swedish Explns. in S. America, 149, 472
Sykes, Gen. Sir P. M., Lady Doctor in Bakhtiariland (review), 386 § ; S. Persia and Great War, 400 (*title only*) ; remarks on "Baghdad to Caspian," 165 ; on "Caspian Provinces of Persia," 415 ; Ser Marco Polo : Notes and Addenda : H. Cordier (review), 143 §
Symonson's map of Kent, 1596..232

T.

Takht-i-Sulaiman, Mt., Elburz, 411
Tandy, Lt.-Col. E. A., Circulation in Earth's Crust, 240 (*title only*), 354 * ; remarks on "Map Projections," 459
Tarkol, Nur valley, Persia, 410
Tarpeian Rock, Olympus, 209, 213
Tasman, Abel J., Reizen van, etc. : R. P. Meyjes, 302 §
Tasmania, Flora of Summit-plateaux, Miss L. S. Gibbs on, 473 §
Taylor, G., Climatic Cycles and Biological Evolution, 396 §
———, Miss S. M., obituary, 238
Teesta valley, Everest route, 122
Tennant, Sir E. P. : *see* Glenconner
———, Lt.-Col. J. E., In Clouds above Baghdad, 289 §
Tennyson quoted on geological change, 371
Thessaly, Plain of, 420
Thompson, G., discoverer of Orange River Falls, 245
Thomson, Sir B., remarks on "World Map before and after Magellan," 442
Throne of Zeus, Olympus, 208, 209, 210, 213
Thuras, A. L., Atlantic Ice obsvns., 314
Timor Id., coral reefs of, 115 ; in Egerton atlas, 285
Tissot on projections, 449, 450
Tod, Lt.-Col. J., Annals . . . of Rajasthan, 137 §
Todd, Lt.-Col. : *see* Wood, Lt.-Col.
Tordesillas, Treaty of, 433, 436
Toscanelli's supposed map, 435

Townley, Sir W., remarks on "Deep-sea Research in E. Ind. Archip.," 120
Townshend, Maj.-Gen. Sir C. V. F., My Campaign in Mesopotamia, 289 §
Trani-Gurna abyss, Olympus, 208
Travel, Fifty Years': F. H. Butler, 391 §; Letters of T—, 1892–1913: R. Kipling, 144 §; Modern T—: N. J. Davidson, 306 §
Tripolis plain, 420
Trissul Mt., Himalayas, 11
Tristan da Cunha, D. M. Gane's Appeal for people of, 313
Tropical Drift Seeds on Irish Coasts, H. B. Guppy on, 307 §
Tukang Besi Ids., E. Indies, structure, 112, 113
Tunakabun province, Persia, 411 *et seq.*
Turkoman robbers, 85–86; T— and Caspian fisheries, 408
Turkestan, Travels in: Capt. L. V. S. Blacker, 480 (*title only*)
Turks in Europe: W. E. D. Allen, 294 §
Tuscarora deep, 356, 363
Typhoons of Far East, L. Froc on, 312 §

U.

UGANDA, Handbook of: H. R. Wallis, 297 §
Ultra-violet light and health, 279
Universities and Geography, 378 *et seq.*
Urquhart, D., ascents in Olympus group, 206

V.

VAN DER LINDEN, H., on Papal Bulls and Spanish and Portuguese rights, 432, 433
Venizelos Peak, Olympus, 209, 210, 213
Verbeek, R. D. M., on geol. structure of Sumatra, 108; on E. Indian submarine topography, 100
Vespucci, Juan, map showing results of Magellan's voyage, 440
Victoria, Lake, Naturalist on: G. O. H. Carpenter, 139 §
Vinci, L. da, Map of, 438, 439
Volcanoes and crustal circulation, 369
Volta, River, recent displacement, 167
Vosges, Jessen on Glacial Cirques in, 145 §
Vowles, A., With Camera in Mesopotamia, 289 §

W.

WALDSEEMÜLLER map, 435, 436
Walker, W. S., Modern Expln. in Oasis of Siwa, 29 *; Siwi Language, 465 §
Wallis, B. C., British Empire, 391 §
———, H. R., Handbook of Uganda, 297 §
Washington, Adm. J., work on place-names, 37
Wayland, E. J., on Rift Valleys, 239
Western Front, Belgium and: Ed. J. Muirhead, 385 §
Wetter trough, E. Indies, 96
Whaling in Antarctic, 187
Wheeler, Capt., Photographic Survey Methods, 277
Whiston and Ditton, scheme for determining position at sea, 254
White Mts., New Hampshire, 24
Williamson, G. C., George, Third Earl of Cumberland, 59 §
Wilmore, A., Groundwork of Modern Geogr., 392 §
Wiltshire, Boundaries of, Lord Fitzmaurice and L. Bown on, 61 §
Winterbotham, Col. H. S. L., Review of Hosmer's 'Geodesy': 231 §; ditto of 'Photogrammetrie aus Laftfahrzeugen' (Profs. Hugershoff and Cranz), 304 §; remarks on "Map Projections," 458; on "Internat. Aeron. Maps," 350
Witu, Sultanate of, R. W. Hamilton on, 70
Wolff, Lt.-Col. A. J., remarks on "Map Projections," 458
Wollaston, A. F. R., Surgeon and Naturalist, Everest expdn., 278
Wood, Col. H., remarks on "Mount Everest," 19
———, and Todd, Lt.-Col., aeroplane circuit of Olympus, 210
Woolley, C. L., Dead Towns and Living Men, 144 §
Wordie, J. M., Present Day Conditions in Spitsbergen, 320 (*title only*)
Workman, Himalayan expdns., 11, 12
World-map before and after Magellan: E. Heawood, 400 (*title only*), 431 *

Y.

YAKS and ponies at high altitudes, 123
Yate, Col. Sir C., remarks on "Caspian Prov. of Persia," 416; on "Visit to Bokhara," 93
Young, A. E., Investgns. into Theory of Map Projections, 133 §
———, E.: *see* Fairgrieve, J.
———, G. W., Mountain Craft, 224 §
"Young Bokhara Party," 75 *et seq.*
Younghusband, Lt.-Col. Sir F., Object of Everest expdn., 271; on natural beauty, 418; Remarks on "Caspian Provinces of Persia," 417; on "From Baghdad to Caspian," 164, 166; on "Four Notes on Map Projections," 460; on "Future of Polar Expln.," 200, 201, 204; on "History of Chronometer," 270; on "Lower Reaches of Orange River," 252; on "Mount Everest," 14, 20; on "Research in E. Ind. Archip.," 118, 121; on "Scenery of Greece," 427, 429; on "Visit to Bokhara," 87; on "World Map before and after Magellan," 442, 445; on "Control of Climate by Lakes," 174, 180
Yukon, Cheechako in Alaska and: C. Cameron, 230 §
Yule, Sir H., Ser Marco Polo: Notes and Addenda: H. Cordier, 143 §

Z.

ZAGROS MTS, Persia, 155
Zanzibar in Egerton atlas, 288
Zarafshan river, Bokhara, 77
Zee-Coe-Steek Mt., Orange River, 246
Zendling's Drift, Orange River, 250
Zon, R., on Forests and Human Progress, 315 §

INDEX TO MAPS

EUROPE.

Belgian-German Boundary Region, Kreis of Eupen, 48; ditto of Malmédy, 49; Olympus, Sketch-map of Massif of, 208

ASIA.

Himalayas—Kamet glaciers, 217; Sketch-map of Mt. Everest region, 272; of neighbourhood of Mt. Everest, 4

Persia—Sketch-map of W. P—, to illustrate Gen. Dunsterville's route, 156; Sketch-map of Caspian Provinces, 404

AFRICA.

Kalahari—Sketch-map of K— Desert and Amboland, 169

Kunene River—Gorges of the Kunene and Rua Cana Falls, 331; Rainfall of K— and Okavango Basins, 323

Niger System—Rivers of W. Coast, showing capture of Niger tributaries, 168

Orange River—Sketch-map of, from Great Falls to sea, 244

NORTH AMERICA.

British Columbia—Sketch-map of N. Selkirks, 24

POLAR REGIONS.

North P— R—, 184; South ditto, 185

GENERAL.

Magellan Cartography: Canerio map, 1502..433; ditto, compared with true configns., 437; Cantino map, 1501–2, Portion of, 432; Gores of globe, circ. 1533, showing Magellan's track, etc., 441; Malay Region in Reinel's map, 440; South America by the same, 440; Ribero map, 1529, compared with true configns., 441; Malay region in same, 441; Southern S. America in same, 1529..440; W. Hemisphere, from inset in Waldseemüller's map of 1507..432; World according to Ptolemy with Behaim's additions, etc., 436

ILLUSTRATIONS AND DIAGRAMS

EUROPE.

Olympus Range—Highest summits, 209; Skolion from near Tarpeian Rock, 213; St. Elias, Prairie des Dieux, and Porta, 213; Summits of Olympus and Trani Gurna, 212

ASIA.

Himalayas—Mt. Everest from Chunjerma, 12; from Kampa Dzong, 13; from Sandakphu, 5; Mount E— and Mtns. to north, 273
Persia, Northern—Baladeh, 408; Plain of Tunakabun, 412; Houses of Mazandaran, 412; Kaleh Dasht, 413; Main chain of Elburz from Nur Ridge, 409; Meshed-i-sar, 409; Tarkol, Nur Valley, 408; Takht-i-Sulaiman from Kaleh Dasht, 413
Persia, Western—Between Kazvin and Manjil, 164; Bisitun village, 156; Inscriptions at Bisitun, 157; Mahidasht, near Kirmanshah, 164; Manjil, 165; On road near Manjil, 165; Summit above Mahidasht, 164; Sultanabad, Street in, 157

AFRICA.

Kunene River—Gorge below Upper Kavale Rapids, 325; Gorge through Serra Cana, 333; Falls of Rua Cana, 333; Kavale Rapids, Lower, 333; ditto, Upper, 324; K— River near Erickson's Drift, 324; Rua Cana Falls, Western Gorge, 333; Western Fall, 325
Orange River—Boulder-strewn bed of side stream, 244; Crossing side stream, 244; Gorge below Great Falls, 245; Gorge in Richtersveld Mts., 245; Koker Boom on plateau, 252; Mud cracking on subsidence of Flood, 253; Ravine eroded in granite, 244; Smooth granite bed of dry Bak River, 252; Steep bank of Lower Orange, 253; Zendling's Drift and Mitre Mt., 252
Siwa Oasis—Entrance to oasis by Maqahhiz Pass, 32; General view of Siwa village, 32; Oasis from top of Siwa, 33; Spring of Tamusi, 33; Siwa town from North, 32; Typical Siwani house, 33

NORTH AMERICA.

British Columbia—Falls of Goldstream, 29; Glacial erratic near headwaters of McCulloch Creek, 25; Gold Range across Columbia River, 25; ditto and Columbia River from Mica Creek, 25, 28; Mt. Argonaut from south, 28; North face of Frenchman's Cap, 25; Panorama of Gold Range, 24; ditto of Selkirk Range, 24; Valley of Downie River, 29

GENERAL.

Aeronautical Maps—British proposals for . . . Conventional signs, 400
Burton, Sir Richard Francis, 382
Chronometer — History of Earnshaw's balance, 266; Harrison's compensation, 259; Harrison's first chronometer: Front and back views, 260; ditto, side view, 261; ditto, balances and gridiron from above, 261
Cook, Capt., Monument to, erected by Capt. Lord Byron, 34; photograph of first plate on monument erected by H.M.S. *Imogene*, 1837..35; ditto of plate added by Capt. Lord George Paulet, 1845, 35
Earth's crust, diagram to illustrate "undertow" in, 364
Projections—Doubly-equidistant projection with centres A (N. Pole) and B (London), 447; ditto of N. Atlantic, 448; Prelim. construcn. of equator and meridians on oblique circumscribed cube, 455; P— of Earth on inclined circumscribed cube, 455; ditto on oblique circumscribed cube, 456

END OF VOL LVII.

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